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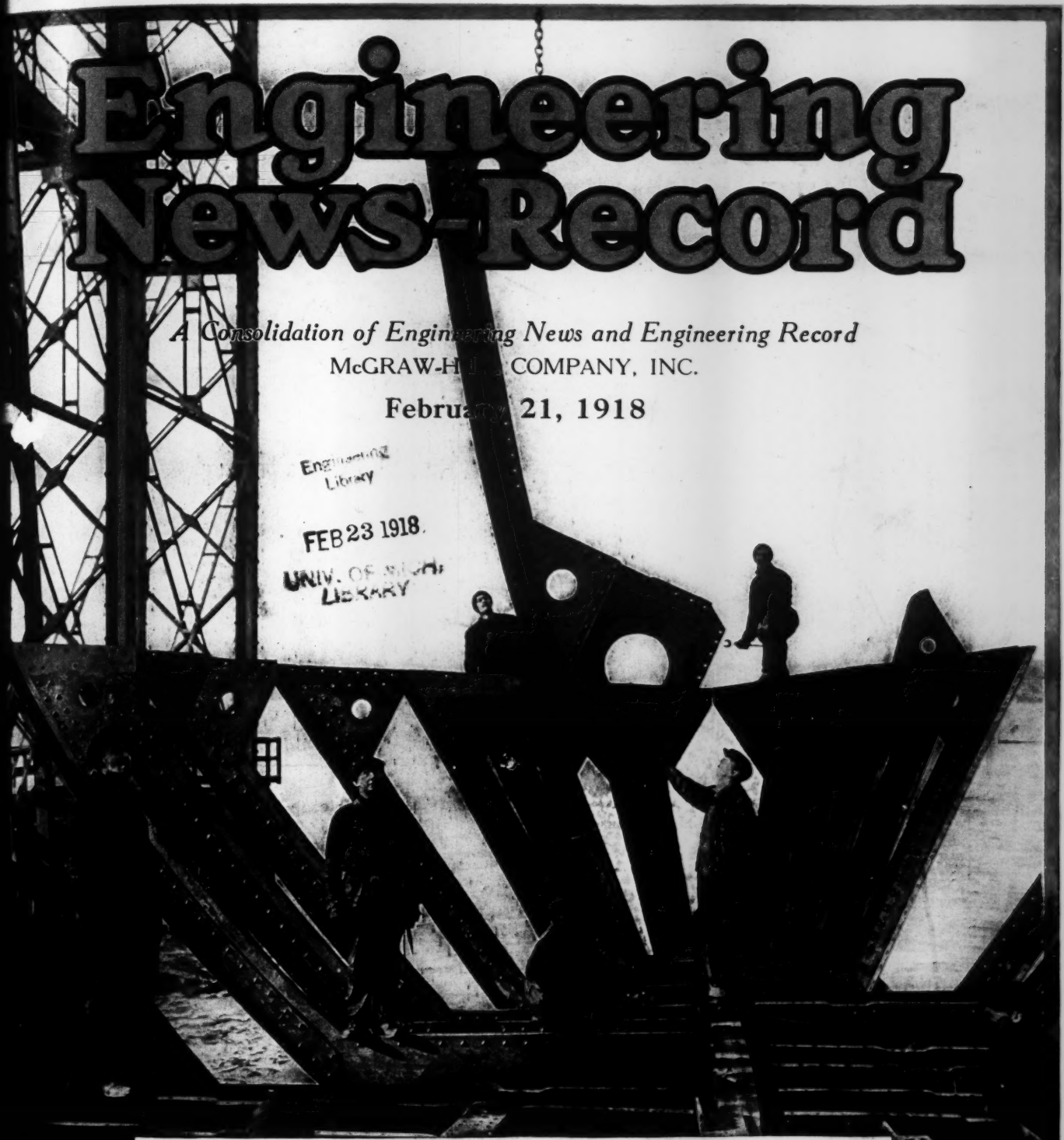

In This Issue:

Railway Yard and Terminal Development for the American Expeditionary Force

BY ROBERT K. TOMLIN, JR.
Engineering News-Record's War Correspondent in France

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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What Is Labor Unrest?

Old-fashioned medicine treated the symptoms of a disease. Science has overthrown this futile method, substituting the search for the cause and directing its attacks, not at the surface, but down deep where the trouble has its origin.

Human society suffers organic disturbances not unlike those of the human body. This generation lies abed, sick from the lack of coördination between its several functions. Old-fashioned doctors say, "Higher wages," "Open shop," "Complete unionization." They would treat symptoms.

A series of editorials which will appear on this page from week to week will point out the seat of the modern illness, identify the causative agencies and indicate the remedy. This, the first of the series, deals with the inherent instability of the body social.

THE human mind is the most complex piece of mechanism in the world. It is the master mechanism. How it works nobody knows. What it will do individually and collectively under any given conditions, nobody knows—not even its owner.

The man who digs your ditches has depths you cannot plumb. You see him come and go every day and his coming and going become a part of your daily habit of thought, like the coming of your morning newspaper. Some day he doesn't blend with the scenery as you are accustomed to viewing it. Unknown to you there has been some crisis in his life; his mental depths are in turmoil; age-old questions come to the surface. Placidity becomes turbulence and you are annoyed—unless you have become similarly turbulent yourself, in which event you are not annoyed. You understand.

Your ditch digger has thousands of years of his ancestors' life and thoughts and yearnings slumbering in his soul and speaking when he is roused. He has not always been a ditch digger. Some centuries past in Asia Minor, in Greece, in Italy, along the whole line of civilization's push upward, he has been oppressor and oppressed, just as you have been—mostly oppressed, for the oppressed have always been in the majority.

One life begins and ends; but the blood-flow is continuous from generation to generation. The thousands of years behind us speak in us and to us and through us every day. The greatest thinkers, ancient and modern, affirm this.

There has been more stirring of the human depths since August, 1914, than there had been in the whole period since our Civil War. All of our accustomed grooves have been upset. In our social bearings we lack a sureness of direction. The guideposts have become weathervanes. Our placid gray matter has been set seething. The former smooth surface of our minds which reflected the current weather, the passing clouds and the orderly seasons is turbulent; the sediment of the centuries is bubbling to the surface from the depths.

We get into channels. Channels are comfortable. They fix direction. Where you are going doesn't worry you. It suffices that you are comfortably on your way. Then something happens and destroys the channel. You and your ditch digger face each other with the eternal question of your mutual relationship in your eyes. The thousands of years back of each of you is compacted in the look. *And you couldn't phrase the question in words if you tried.* You don't try, either of you. Instinctively you know it, but to save your souls neither of you could say it.

If you tried to say it, you would both use the words you used in the channel—wages, open shop, cost of living. Especially the ditch digger would. He couldn't phrase the concentrated protest of ten thousand years in a moment of crisis any more than he could think it logically in a year in the channel. It is too big, too overwhelming, too much a rising of his whole being.

So when you ask him what he is turbulent about, don't quibble about the lack of a clear-cut answer. It can't be made; you couldn't make it yourself. But if you want his answer, get it in his reactions. Hear him give approval to war against the Kaiser; note the set of his features when the war profiteer is mentioned; watch him as he listens by the hour to the man you would call an agitator; catch his constant sanction to the opportunities open alike to everybody and his equally constant suspicion of opportunities not possible for *his* children. The public schools are never afraid to go direct to the people for money; the universities are.

Business based on the idea of maximum cash returns to the owner, at any cost to competitors, to labor, to the social order, to the Government, was bound to be a boomerang.

The labor unrest is the instinctive protest of ten thousand years against all this.

Stop Burning Coal to Waste Water

THAT using high-priced labor and coal to pump water to waste is criminal should be apparent even to blind city officials after a general coal famine in zero weather, with snow and ice blockades. Efficient measures to stop this joint waste of water, coal, labor and money, with its constant threat to property and life here and its drag on the war abroad, should be adopted by all sinning cities as a part of the municipal war programs urged in these columns Jan. 3 and 10.

Canadian Society Becomes Institution

THE Canadian Society of Civil Engineers changed more than its name at the annual meeting which was reported in these columns Feb. 7. It is now an institution for the advancement of all engineers of whatever branch of the profession. In this respect it has taken on its shoulders for Canada the work for which we look to the Engineering Council in this country. Canada and Canadian engineers are sure to be the better for the adoption of this broad policy. With the far smaller population of the Dominion, it might have been years before strong mining, mechanical and other engineering societies grew up and combined, as those societies have in this country, for the advancement of the profession as a whole; and in the meantime there is much to be done. The new policy of holding an official meeting once a year in every province cannot but promote the solidarity of the society and the interest and active participation of the members in its affairs. Could not our own civil engineering society adopt some similar plan with great gain in these same respects?

Probably No Waterways Commission

THE turn of events has made it practically certain that the hastily prepared waterways commission amendment to the last rivers and harbors act will never be made effective. That amendment, it will be remembered, tacked on to the bill appropriating funds for river and harbor work a provision authorizing the President to appoint a commission of seven men with the widest and vaguest powers of investigation of the uses of waterways, either as a source of power or for transportation. A sum of money barely sufficient to pay office expenses was provided in addition to the commissioners' salaries. Those interested have vainly waited for the President to appoint the members of the commission. His postponement of such appointments has been due to reasons known only to himself; but circumstances have now combined to suggest an indefinite postponement. The taking over of the railways brings in its train the possibility, in fact the strong probability, of the taking over of the waterways. The urgent demands for more coalless power points inevitably to a water-power act in the present Congress. With these two Governmental relations to water and its uses already in being, how confused would become the situation were the President to inject another separate control or investigatory power lodged in a waterways commission.

Coöperation in Power Development

ENGINEERS have long been aware of the great economies which can be effected by substituting coöperative for competitive conditions in the operation of public utilities. The realization of these economies has met with obstruction both from the inside on the part of those who objected to agreement with old rivals, and from the outside on the part of the public. But under war conditions the pressure of urgent necessity is forcing the substitution of coöperation for competition on a scale hitherto deemed impossible. The same public authorities which have opposed combinations, in deference to public opinion and statute enactments, are now taking the lead in bringing them about.

A remarkable example of this is the recent combination for operating purposes of the four great electric power companies which distribute current to the territory around San Francisco. Under the direction and authority of the Railroad Commission of California, these four companies have placed their entire plants under the authority of P. M. Downing, chief engineer of the Pacific Gas and Electric Co., as general manager. The combined systems have a total capacity of 377,600 kw., of which 240,000 is developed from water power, and they serve 40,000 square miles.

Heretofore the physical connection of large generating systems owned by different companies has been considered chiefly as an emergency measure by which one could be drawn on to help tide another over its peak load in case of emergency. Where constructed at all, such interconnections have been built with this alone in view and the capacity of the apparatus installed has not been sufficient to permit a large transfer of load from one system to another. When large systems are connected with a view to maximum economy in operation, apparatus of much more liberal capacity is required.

Considerable problems of an engineering and financial nature must be worked out in solving the question of maximum economy combined with reliability of service. It is obvious that where two rival systems are serving the same territory, it will be possible with a small amount of interconnection materially to cut down the capacity of the standby steam stations required in connection with hydro-electric plants, while to transfer the load on a hydro-electric plant to another a hundred miles distant would require a large investment.

In California the problem is this year complicated by the phenomenal drought. With the least rainfall thus far this season for 69 years, the question of reservoir storage becomes of prime importance. So far as possible the load will have to be concentrated on those plants which have the largest reservoir supply and those where climatic conditions afford the largest dry-season flow.

An additional factor in the problem is the imperative demand for additional power. It is estimated that the four great electric power companies supplying the region around San Francisco Bay will have this year a peak-load demand 50,000 kw. in excess of 1917. If the four systems were to continue to operate separately, the bulk of this demand would have to be supplied by steam equipment, and this, it is estimated, would mean the consumption of about a million barrels of fuel oil.

It is most urgent, therefore, that the additional power required for the shipyards and munition plants in the San Francisco district shall be obtained from hydro-electric development. There are large water powers available in northern California, but to develop and bring them to market means the investment of a large amount of capital. Probably at least $5,000,000 must be expended on power plants and transmission lines to supply this year's demand. The individual companies are unable at the present time to raise additional capital for construction work. It seems inevitable that financial coöperation, as well as operating coöperation, will have to be effected in order to make the financing of new construction possible. Combination of the systems for physical operation also makes financial combination almost imperative. It will be as necessary to pool the expenses and receipts, regardless of which company's plant generates and distributes the current, as it is in the operation of the railways where the traffic is concentrated under the Government's control.

Judged by the Results

WAR expenditures, especially for construction work, are not most economical when the work is secured at the lowest prices, because of the extraordinary value of the time element. In spite of general recognition of this fact, the Shipping Board itself is directing much penny-wise criticism at some of the foremost piledriving contractors in the world because some of the costs on its shipways have run high.

If it were shown that these high costs were the result of graft, the contractors in question would have no defense. This, however, is not even alleged in the case which has been made the most of in the public press—the yard at Hog Island.

Here a contract larger than any of its sort that has ever been attempted was plunged into last October with feverish haste to make up for the golden summer lost in squabbling over exactly what should be built. The advance planning of the general contract may not have been as perfect as is usual—in fact, could not have been, because the urgency demanded that no time be spent which could be saved by spending money. Saving a few millions in the face of the present shipping crisis, when that saving meant the loss of precious time, would not have been parsimonious, but criminal.

But the Shipping Board has not produced the ships which were hoped for. Even the report of Lloyds, said to be unduly optimistic, esimates that we will put in the water during 1918 less than half the tonnage the country has been lead to expect—a tonnage which, it seems, might have been realized with better management. Perhaps some showing of zeal, some appearance of efficiency was necessary to offset the damning effect of this bald fact.

But these scandalous contractors—are *they* producing anything? After some weeks and months of struggling with a tremendous task on an unbroken waste of river bank in the dead of the severest winter the Atlantic coast has known for two decades, these same contractors are producing shipways on which keels can be laid—and producing them more quickly than their brothers who are not engaged at Government shipyards conceived to be possible. Although materials furnished through Washington failed to arrive, although rail facilities proved too slender and overeager foremen were reduced to driving cars of misdelivered cedar telephone poles, those ways have been built. Yet were the contractors and their methods found fault with, and though they were actually delivering the work, the contracts were cut down and reorganized.

A representative of the Shipping Board was sent to teach these wasteful contractors proper economy with Government funds. To his praise be it said, the original construction program was almost immediately restored, since it seemed in a fair way to be completed successfully. Those in high authority said to the press, "Lo, our representative hath wrought a miracle!" and to the contractors, "Work your heads off and make up for the time *you* have lost." Since then, it is rumored, this genial management has found it necessary to reduce the speed of the entire work because it was unable to supply piles at a normal rate.

Bricks without straw—by the contractors. Engineers and the public will judge both them and the Shipping Board by the results they produce.

Railroad Lobbies Still Needed

OWNERS of both large and small railroads have occasion for misgivings as to the ultimate fate of their properties. The attitude of Mr. McAdoo, Director General, in dismissing this question with the assertion that the taking over of the railroads by the Government was purely a war measure, does not satisfy. There is too little certainty as to what the public will demand. Because the public may insist on permanent government operation, the small-road owners are fearful, as pointed out in these columns Jan. 31, p. 197, of being left out of the reckoning. The owners of the large roads are also anxious, naturally, as to how they will be compensated if they have to sell out to the government. But because the properties may be turned back to them they have decided misgivings regarding the Director General's order of Jan. 28 forbidding the employment of agents to affect legislation.

There is no indication that the numerous state legislatures have in any way lessened their efforts because of the Government's assumption of the operation of the railroads; and whatever undue influence railroad lobbyists may have exerted in the past, to forbid the companies any sort of opportunity to be heard is to open the way to every kind of ill-advised legislation—fostered not so much, pernaps, by wilful antagonism as by ignorance of railroad needs and limitations. So long as the Government operates the railroads it must, of course, bear any extra burden imposed by these laws, but there is reason for grave apprehension if when private operation is restored the managers must face a fresh lot of restrictive and conflicting state laws.

The Administration needs to do more than run the railroads during the war; it needs to look out for the future, so that whatever the final decision as to railroad control, the railroads can effectively play the important role that will be theirs in the years of reconstruction and readjustment after the war.

Concrete-Arch Railway Bridge Costs Less Than Steel

Double-Track Concrete Structure Replaces Old Iron Viaduct—Spandrel Arches Support Deck—Expansion Joints Have Rails for Sliding Surfaces

REPLACEMENT of an old wrought-iron single-track viaduct with a concrete-arch double-track structure carrying the Chicago & Eastern Illinois R.R. over the Okaw River near Sullivan, Ill., has been made necessary by the great increase in traffic and by the fact that the old structure is not adapted for the heavy class of locomotives now employed. Under present conditions it was found that the cost of the concrete bridge would be less than for a new steel one. The iron viaduct is 1400 ft. long between abutments, with rail level 73 ft. above low water. The new concrete bridge is 526 ft. long, with its rails 77 ft. above low water, and has 1600 ft. of approach fills. A special point besides the choice of concrete on account of low first cost and maintenance charges is the selection of the spandrel-arch type of bridge on account of the height from the arch spans to the deck level. A feature of the construction plant is the use of the spouting system to deliver concrete over the entire length of the bridge, with the main line of spouting suspended from a cable crossing the site diagonally.

The old structure was built in 1892, at the time of the construction of this part of the road, and is of interest now from the use of wrought iron instead of steel. Plate-girder spans of 60 ft. alternate with 30-ft. spans on the towers, and a deck-truss span of 100 ft. crosses the river. The metal is mainly in good condition. A few of the concrete pedestals have had to be bound with iron at the top on account of cracks. One of the concrete piers of the river span is cracked also, and this has been reinforced by strapping it with iron bands. Trains are required to reduce speed to 10 m.p.h. in passing over the viaduct.

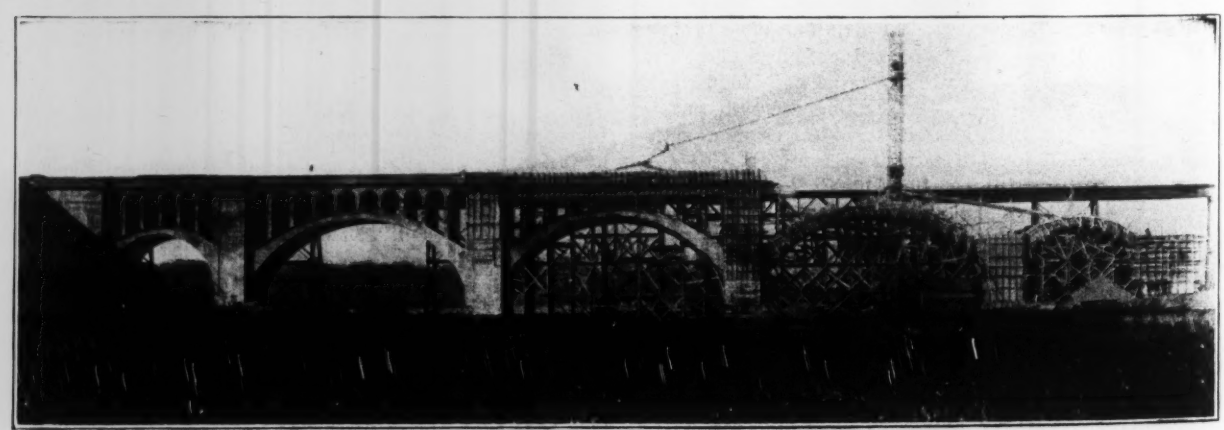
Concrete was adopted for the new structure partly on account of the high cost and limited supply of steel, but largely on account of practically eliminating future maintenance cost. With the prices prevailing at the time of construction, the cost of the concrete structure and approach fills will be considerably less than that for a new double-track steel viaduct. The work includes 17,000 cu.yd. of concrete and 400,000 cu.yd. of fill. The cost is estimated at $190,000 and $85,000 respectively, or a total of $275,000. Work was begun early in 1917, and it is expected to have it completed early in 1918.

Location of the new work alongside the old viaduct allows the construction to be carried on without interfering with the heavy traffic on the present stretch of single-track line. This arrangement also slightly improves the alignment and grade, the new rail level being about 4 ft. higher than on the old location. The distance between center lines of the two structures is 100 ft.

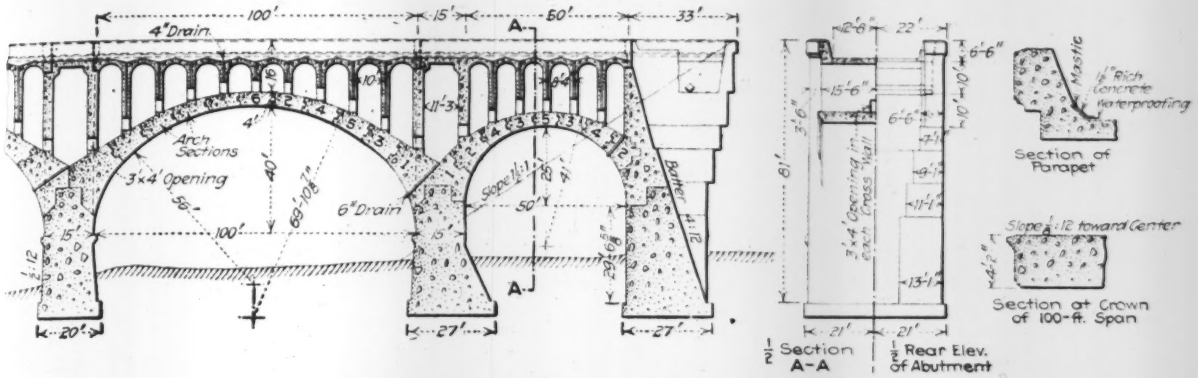
The concrete bridge consists of three 100-ft. and two 50-ft. arch spans, the rise of arch being 40 ft. and 25 ft. respectively. The main arches carry cross walls with spandrel arches supporting the deck slab. In order to reduce the amount of concrete, the ends of the approach fills extend across the 50-ft. end spans. The abutments therefore require only short side walls, these being cantilevered 8 ft. from the body of the abutment and covered by the top of the fill. Heavy steel reinforcement is used in the arches and in the sides of the piers and abutments. The thickness of concrete at the crown of the arches is 4 ft., being the same in all spans to give a good appearance. The design and details are shown in the accompanying views and drawings.

The foundations are in a bed of solid blue shale, which borings have shown to be at least 40 ft. deep. Over this is about 15 ft. of earth and gravel. The shale is excavated to a depth of from 3½ to 7 ft. for the piers. The load is about 10 tons per sq.ft. of base. Loading tests have been made up to 22 tons per sq.ft. without causing appreciable settlement or compression of the shale. Cofferdams for the two river piers were made of timber sheeting driven through the water-bearing gravel into the shale. The excavation was done by hand, the material being removed in dump buckets handled by a stiff-leg derrick.

Limestone was selected for the concrete aggregate, as the quarry is on the railway company's line, and the haul is in the direction of empty-car movement, thus requir-



FIVE-ARCH CONCRETE BRIDGE REPLACES OLD IRON VIADUCT



PART SECTIONAL ELEVATION AND DETAILS OF NEW BRIDGE

ing a minimum of car service. These empty cars are largely gondolas used in coal traffic and are therefore suitable for handling stone. About 11 cars of stone and sand are delivered daily and the facilities provided are sufficient for unloading 15 cars daily.

Concrete is made 1:3:6 for the piers and the foundations; 1:2:4 for the main arches, and 1:2½:5 for the spandrel arches, deck and parapets. The size of stone is 1½-in. to 2-in. The only provision for surface finish is care in placing the concrete against the forms. As the bridge is in the open country no expense for special surface treatment is warranted. The broad surfaces of the piers are relieved by large panels, and there are moldings on the parapet walls and the faces of the arches.

Concreting of the arches is done in sections about 10 ft. long over the full width of the arch, the sections being connected by horizontal mortise joints in the radial faces. It was intended at first to employ a greater number of sections, but the substantial falsework construction and the capacity of the concreting plant allowed the larger and heavier sections to be laid. The top of the 18-in. deck slab slopes ¼ in. per ft. toward the center line. This forms a central drain, in which are 4-in. drain holes in the cross walls, ending in the rectangular opening at the base of each wall. At the haunches are 6-in. drains from the hollow portions of the piers.

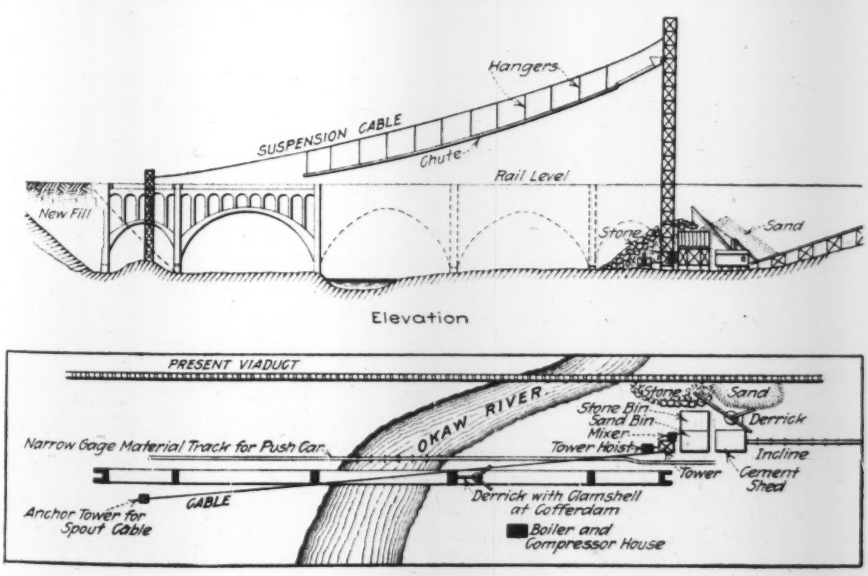
Parapet walls 5½ ft. high above the deck give the necessary appearance of depth over the relatively thin arches. On the deck slab will be a bottom fill of old broken tile, giving good drainage. On this will be stone ballast 2 ft. deep under the ties, bringing the base of rail level with top of the parapet. The width between parapets is 25 ft. 4 in., increased to 29 ft. at the abutments and to 36 ft. at the piers.

The reinforcement consists of square corrugated bars. The bars near the exposed faces of arches and piers are supported by concrete blocks. Ordinarily these are removed before the concreting. If any happen to be left in place they do not form unsightly spots, as might be the case with wood blocks.

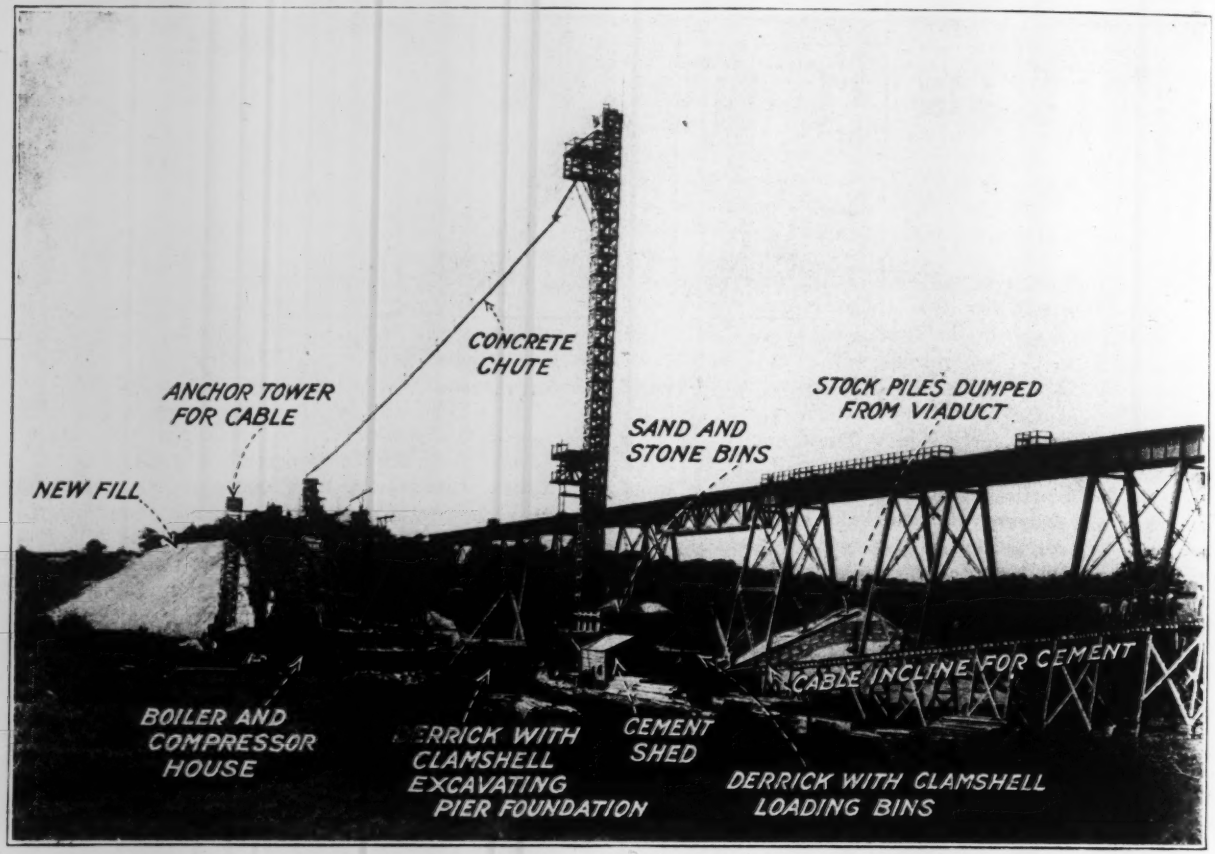
Expansion joints are formed in the deck slab at each pier and abutment, as shown by the detail drawing. In the horizontal part of the joint, provision for sliding is made by means of short pieces of old rails embedded in the base of slab and top of pier. The bases of the rails, which form contact surfaces, project ¼ in. from the concrete so as to maintain an open joint ¼ in. wide. Beyond the rails this space is filled with two layers of felt. The vertical part of the joint is filled with two layers of felt to within 2 in. of the top, above which the joint is filled with asphalt.

Concreting of the entire structure is done by spouting from a tower at a central mixing plant located on the river bank. A ¾-yd. mixer delivers directly to the bucket of an elevator tower 180 ft. high. This tower is of unusual height for work in open country, and is well guyed against wind. At the lower part it is braced by additional bents on one side, forming an auxiliary tower.

The steel spouting is suspended from a 1¼-in. cable of 350-ft. span which crosses the bridge site diagonally. Its upper end is attached to



SKETCH SHOWS LAYOUT OF CONTRACTOR'S PLANT



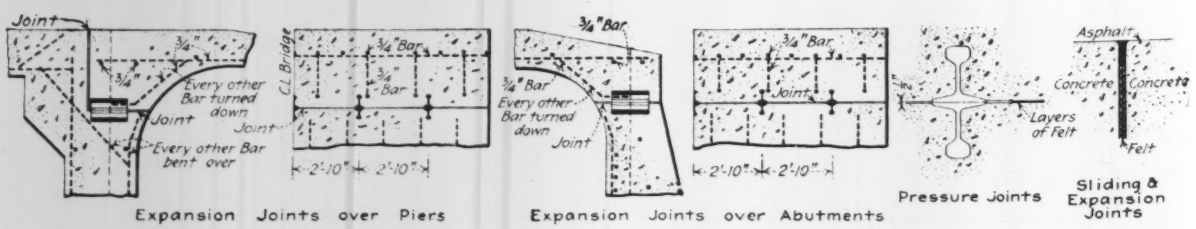
CONSTRUCTION PLANT FOR BUILDING NEW CONCRETE ARCH BRIDGE ALONGSIDE OLD STRUCTURE

the elevator tower, and the lower end to a tower a little higher than the bridge and on the opposite side. From the end of this main line of spouting portable sections are laid to the forms. The maximum distance from the tower to the point of delivery at the forms (for the abutment walls) is 350 feet.

Pneumatic placing of concrete was used at the beginning of the work. The steam-driven compressor had a capacity of 850 cu.ft. of free air per minute, and gave a pressure of 100 lb. for forcing the concrete through a 6-in. pipe. The greatest length of discharge pipe used was 350 ft. The mixer furnished, however, was too small for the requirements, the maximum amount placed being 100 cu.yd. in a 10-hr. day. This rate of progress was insufficient to complete the work in the required time and a larger pneumatic mixer was not then obtainable. The contractor therefore installed the present plant, with drum mixer, elevator tower and gravity chutes. With this plant a rate of 35 yd. per hour has been made without reaching its full capacity, and it is estimated that 325 yd. can be placed in a working day.

Cement is unloaded from a car on a siding at the north end of the bridge. The sacks are lowered to a shed at the mixer by a car on a cable incline of 24-in. gage, built on a trestle of 10% grade. Stone and sand are dumped from the deck of the present viaduct, a height of some 65 ft. The materials are delivered in drop-bottom gondola cars having a row of doors in each side of the floor. To facilitate dumping and to keep the material from fouling the track, the ends of the ties at the dumping point were cut off at the stringers. A derrick with grab bucket transfers the sand and stone from the stockpiles to the bins above the mixer. A narrow-gage track laid alongside the work, at the ground level, provides for the handling of lumber and reinforcing bars on push cars.

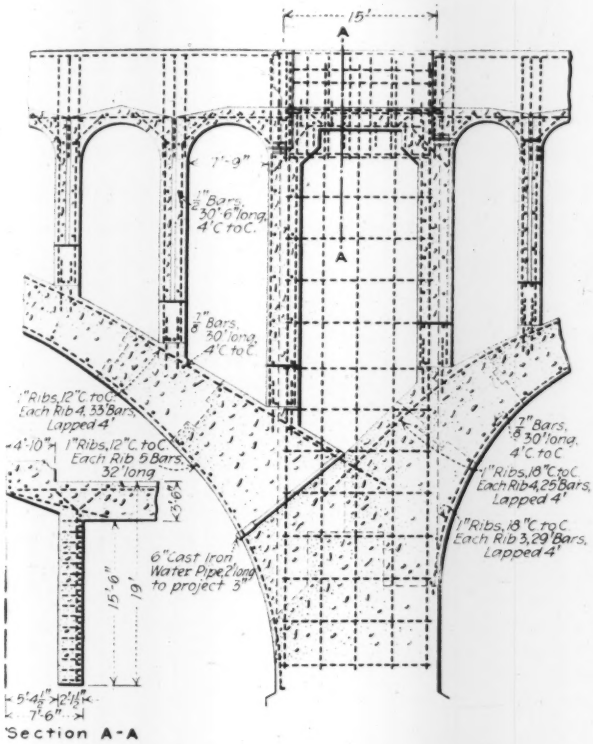
Very substantial falsework is employed, and concreting can be carried on at any point of the arch without



DETAILS OF EXPANSION JOINTS BETWEEN DECK AND PIERS, SHOWING USE OF RAILS FOR CONTACT SURFACES

special care to balance the load. Round timbers are used extensively, as these are readily obtainable in the vicinity. The bents are spaced 10 ft. c. to c. and have five posts in each bent. A hand derrick is used in erecting the timbers.

Approach fills at either end, with a maximum height of about 70 ft., are being made with material from borrow pits. The work is being done with 4-yd. dump cars and dinky locomotives on tracks of 3-ft. gage. The


15'
A
1'-9"
1" Bars, 30' 6" long, 4' C to C.
A
7" Bars, 6 30' long, 4' C to C.
1" Ribs, 12" C to C. Each Rib 4, 33 Bars, Lapped 4'
4'-10"
1" Ribs, 12" C to C. Each Rib 5 Bars, 32' long
7" Bars, 8 30' long, 4' C to C.
1" Ribs, 18" C to C. Each Rib 4, 25 Bars, Lapped 4'
1" Ribs, 18" C to C. Each Rib 3, 29 Bars, Lapped 4'
6" Cast Iron Water Pipe, 2 long to project 3"
15'-6"
19'
5'-4½"
7'-6"
Section A-A

TYPICAL ARRANGEMENT OF REINFORCEMENT

weight of the high fill on the south end caused a lateral movement of the ground which began to shift the old viaduct out of line. To check this a fill of earth and clay was dumped on the east side of the structure, next to the new bridge. For this work a third rail was laid upon the viaduct to allow the narrow-gage equipment to be used. Timbers were bolted to some of the braces to reinforce them under the load of the dumped material, and at one point it was necessary to remove some of this material to relieve the lateral pressure on the columns.

Two of the iron towers near the south end had their foundations in what was apparently an old stream bed. In constructing the fill across this old channel considerable difficulty was experienced from slides and movement of material above the soapstone stratum. Part of the vertical load as well as part of the thrust due to the new fill was relieved from these towers by driving pile bents to support the girders until the completion of the new structure.

As on many works at this time, there was difficulty in getting men and keeping them on the job, in spite of good pay and good accommodations at the camp. While the contractor's force on the concreting averaged 63 men, the number on the half-monthly payroll averaged 106. Many of the men sent out by labor agencies would merely stop and look over the work, and then "flip" a freight train to move on to some other place.

Design and construction of the bridge are under the direction of L. C. Hartley, chief engineer, and J. E. Bernhardt, bridge engineer, of the Chicago & Eastern Illinois R.R. J. H. Titus is assistant engineer in charge of construction. The Condron Co. acted as consulting engineers. J. J. O'Heron & Co. (John J. O'Heron and T. Frank Quilty) are the general contractors, and Roberts Brothers are the subcontractors for the grading. All the engineers and contractors have their headquarters at Chicago.

Removable Spans Required Over Dredged Ditches

Types Available for Various Lengths and for Light and Heavy Traffic Are Discussed by Illinois Bridge Engineer

SELECTION of the type of bridge over ditches in drainage districts is in part dependent upon the future operation and maintenance of the ditch. If cleaning with a dredge boat is necessary some type of removable superstructure should be chosen. In a paper presented before the Illinois County Superintendents of Highways, Jan. 12, G. F. Burch, acting bridge engineer, State Highway Department, gave the following considerations which should be observed in the design of removable spans:

For spans up to 45 or 50 ft. steel I-beams are economical, and for longer spans steel trusses should be used. On light-traveled roads the floor may be ordinary or creosoted plank. On main traveled roads a more permanent type of floor should be used, such as creosoted wood blocks laid on creosoted sub-plank or a removable reinforced-concrete floor with any suitable type of wearing surface. The concrete floor should be poured in place so that each block will have an even bearing upon the joists, and the blocks should be of such a size that they may readily be removed. A riveted truss is preferable to a pin-connected truss, as it is stiffer and less subject to vibration. Field connections of truss spans should be bolted and not riveted, to facilitate removal. Holes should be reamed with the members assembled and the bolts should be turned to a driving fit. When the members are assembled at the shop for reaming they should be match-marked to assure perfect matching of the holes in the assemblage and erection.

For bridges which do not require removal, reinforced concrete is the most economical material. The first cost is seldom more than for a steel bridge and it is generally less. About two years ago, when steel bridges, erected, could be bought for less than three cents a pound, it was often a matter of close estimating to determine whether a steel bridge or a concrete bridge would cost most. At the present time, with the price of steel almost prohibitive, there are few cases in which a concrete bridge cannot be built for considerably less than a steel bridge. A concrete bridge has an added advantage in that it requires no maintenance except for the wearing surface upon the roadway.

Tells Why City Salaries Should Be Standardized

Buffalo Clerk Advocates Plan Affecting Pay of 8000 Employees, in Interest of Efficiency and Economy

A REPORT favoring the standardization of the salaries of all the municipal employees of Buffalo has been submitted to the council or commission of that city by Daniel J. Sweeny, City Clerk. The report presents the arguments for standardization so succinctly that it is reprinted here:

In accordance with the wishes and pursuant to the direction of the council, I made investigations of city salaries with particular reference to standardization plans for the establishment of greater efficiency and the elimination of chaotic salary conditions in the city government. By nature of the functions of municipal government the problem of securing efficiency and economy in service reduces itself largely to securing the maximum efficiency in the individual employees who make up its organization. The number of city employees is about 8000, with an annual payroll in excess of $7,000,000. Thus it will be seen that a large percentage of the operating expenditures of the city government is for salaries of officers and employees, and, consequently, to insure the maximum of economy it is necessary to secure the maximum of return in services for payroll expenditures.

The efficiency movement is the second step in civil service reform. The only argument for the merit system which need be advanced, and the only argument advanced for the substitution of the merit system for the spoils system, is that it tends to increase efficiency and economy in the public service. It is not enough, however, to recruit the service with capable and industrious men and women; it is equally important to see that they retain their initial enthusiasm and that they develop in usefulness.

The standardization plan submitted to the council today contemplates the establishment of two distinct and advanced merit principles:

First—The creation by ordinance of definite salary grades with related work standards in every branch of the municipal service.

Second—It establishes for each grade a range of salary or compensation enabling an employee, without change of duties, to receive pay increases commensurate with the extent to which he or she increases his or her value through individual merit and seniority of service.

It is a generally conceded principle that there are certain limits to the compensation which should be allowed for a given kind of employment, the minimum limit to apply to the incumbent when he or she enters the service, and the maximum limit representing the greatest value his or her service can have in that particular position, no matter how efficient the employee may become. If, under extraordinary economic conditions it should be deemed advisable and just to provide for payments in excess of the fixed rates, these excess payments should be listed as emergency payments to cease when the emergency has passed. The fixed rates, however, ought not to change in any short space of time, for they should represent the value to the city of specified work performed. Advancement from the minimum to the maximum rate is to be made as a reward for meritorious service, increased efficiency and experience. The system never will be a real merit system unless increases in pay and promotion, as well as original appointments, are based upon merit.

Depth the First Consideration in Drainage Ditches

Main Lines Fed from Tile Drains Must Be at Least 8-Ft. Deep—Costs and Methods in One Indiana County

BY RICHARD L. LONGSHORE
Deputy County Engineer, Adams County, Decatur, Ind.

THERE is a tendency in the layout of widespread drainage systems to design the main ditches—lines that take care of the outflow of many tile drains and which may extend over a number of miles—too shallow to carry the load placed upon them. In Adams County, Indiana, is under way a system of such ditches which have been dug much deeper than is customary. The reasons underlying the change in design and the methods and costs of digging the ditches form the subject hereof.

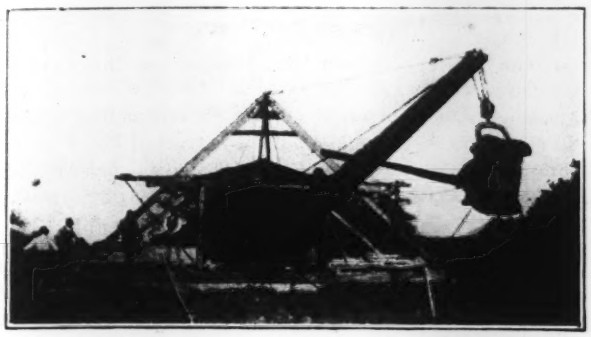
Adams County, with a total area of 337 square miles, is distinctly a farm county. More than 96% of its entire area is in farms and more than 75% is under cultivation. Of this cultivated area fully 80% is dependent on artificial drainage. The clay and heavy black loam soils of the county reach the highest productiveness only when thoroughly drained by means of drain tile. With the average land values at $200 per acre and the present high prices of farm products, the farmer is turning his attention more each year to the construction and maintenance of adequate drainage systems.

The accepted standard for farm drainage systems is a line of 4-in. tile every 66 ft. These tile are laid in 24- to 30-in. trenches drained into 8-in. tile at a 30-in. depth. These 8-in. tile follow the natural depressions and water courses of the land, running either into a county or community drain. These outlet drains are being tiled up to and including 30-in. pipes. The average depth of such drains ranges from 4 to 16 ft. For drains

CLEANING UP MAIN DITCH WITH FLOATING DREDGE

above this size open ditches are used. These ditches flow into creeks or natural streams. Since the slope of most of these streams is between 1 and 2 ft. per thousand, it is nearly always necessary to open and improve the channel throughout the entire length. The farmer at the source of a drainage system is thus often interested in the construction and maintenance of 10 to 20 miles of drain.

The first open ditches were constructed from 3 to 6 ft. in depth and of sufficient size to carry surface water only. With the extensive subdrainage of the land it has become necessary to reconstruct these main outlet drains with sufficient depth and capacity to take care of the new subdrainage. During the last three years county drains have been built under the direct supervision of this office as follows: 36 miles of outlet open drain,



DITCHING MACHINE WORKING IN NEW CUT

comprising three main lines, 14, 12 and 3 miles in length and two branches of 3 and 4 miles in length. The bottom widths of the channels range from 6 to 16 ft. and the depths from 8 to 14 ft. In designing these drains depth was considered first of all. Eight feet was adopted as the minimum depth and a channel was then designed sufficient to carry 50% more than the maximum runoff as computed from available data.

Two reasons may be stated for maintaining this minimum depth of 8 ft:

(1) The average depth of lateral tile outlet drains at the junction with the open ditch is 6 ft. Freezing is very destructive to a tile system with stagnant water in the pipes, especially at the outlet, where the drain is open to the air. Therefore the open drain must be at least 2 ft. deeper so that the entire tile system may drain off and be completely dry before hard freezing. When the breakup comes in the spring it is important that the open drain be deep enough to carry all surface water so that the water level is below the tile before the subdrains begin to flow. The subdrains must carry off practically all stored rainfall from December to April, besides the heavy spring rains, inside a few days. A difference of two weeks in the effective operation of the subdrains in spring makes a vast difference in the farming operations of the whole season.

(2) The land along the line of the open drains is often the most productive on the farm and an overflow even for a short time during the summer season would be very destructive. The average rainfall in this district is 32 in. per year with a maximum recorded monthly fall of 8.35 in., yet during the two years the new drains have been in operation the water level has never yet reached the top of the channel, except for short periods at the outlet, and this was caused by backwater from the river. Even in these places the deep channel caused the water to recede in one-fourth the time required before the improvement.

The excavation for the 12- to 16-ft. bottoms was made with a floating dredge having a 1½-yd. dipper and the smaller bottoms were excavated by means of ditching machines, or as they are locally called, "dry-land dredges," with ½-yd. dippers. The contract prices ranged from 6c. per cu.yd. for wet dredge work to 10, 14 and 15c. per cu.yd. for dry-land work. The assessment sheets including all supervision ranged from $1.25 per acre for wet dredge work to $3.00 per acre for dry dredge work. Notwithstanding the difference in price the dry dredge work is the more satisfactory and wherever a machine of this type is practicable, the taxpayers insist on its use.

Even on the smaller work the dry dredge is taking the place of teams and scoops. The first cost of a machine is low (from $3500 to $5000) and the operating and fuel costs are low. The dry dredge can be operated by a crew of four men and can dig to 15-ft. depths, while teams are limited to about 6-ft. depths, and require three to four men besides drivers for every four teams.

Machines of this type work to best advantage by starting at the outlet and digging against a practically dry face. The ditch is free from stagnant water, the banks may be cut to the desired slope, and there is no danger of silting the channel as with a wet dredge.

One feature of the work, on the smaller ditches especially, that should have attention is the leveling of the spoil bank. On the Adams County work it was provided that all earth should be piled back of a 6-ft. clear berm on the smaller channels and a 14-ft. berm on the larger. It was expected that on the smaller drains at least the land owner would level the spoil bank. Some few land owners have done this (at a small cost), but in the majority of cases the earth remains where it was deposited. The weight of this mass of earth so near the channel is likely to cause slipping and caving, but as yet, owing to the character of the soil, there has been but little trouble.

Americans Build Model Highway in Peking

The scheme of a road from Peking to Tungchow, China, has been under discussion for some time, and its adoption in a practicable form is due to the urgent need of finding employment at this season of the year for some of the persons left destitute by the serious floods of last fall. Final arrangements were completed at a conference held recently between the Peking representatives of the Rockefeller Foundation and the director general of the Chinese Flood Relief and Conservancy Commission for the construction of the 15 miles of pavement between the two cities. The American Red Cross has appropriated $100,000 and the Chinese Government has promised to deposit an equal amount to cover the cost of the work. Two Chinese, one as director and the other as technical expert, will have the matter in charge, but an American engineer, who will probably be detailed from among those now engaged in railroad building in China, will keep the matter under his immediate attention.

American Railway Yard and Terminal Development in France Presents Many New Problems

Engineers Preparing for Big Construction Program at French Seaports—At Docking Basins Readjustment of Track System for American Rolling Stock Is Necessary—Training School for Traffic Officers Proposed

By Robert K. Tomlin, Jr.
"Engineering News-Record's" War Correspondent in France

TRACKAGE in railway yards alone equivalent in aggregate length to a standard-gage line from New York to Chicago is merely one detail of the colossal program of construction which the occupation of French territory by the ultimate quota of the American Expeditionary Force has demanded. And let it be understood at the outset that this does not include main-line construction and repair or narrow-gage, light railway track; it is merely the new trackage required in the immediate vicinity of the huge seaport freight terminals, classification depots and warehouses which United States forces are building or planning to build in France in order that supplies and munitions in staggering quantities may be received and routed expeditiously from ships to points at the front. This information I obtained in interviews with two of the high ranking officers on the staff of the director general of transportation—one the general manager, and the other the engineer of design and construction. Both held high executive positions in a large railroad organization before the war.

Transportation the Immediate Need

Without doubt transportation is the immediate big business of the war for us. Practically everything which our fighting forces will need in the conduct of field operations must come from across the Atlantic, for the available supply of local equipment for American troops is almost negligible. The problem resolves itself, therefore, into one of providing facilities for receiving huge volumes of freight at the waterfront, and either delivering it to the interior or storing it for future use. As one engineer officer expressed it, this phase of our task is not war in the popular conception of the word, but a gigantic business enterprise, which, to insure success, must be conducted on the best American business principles.

Along with the railway yard construction work will go the building of innumerable storehouses and classification depots, the provision of mechanical equipment for the handling of freight, and the enlargement of port facilities such as wharves and docks.

It was impressed upon me very forcibly that the great need now is for cars, which must all come from the States, for crews to load and unload them, and for a skilled force to operate the trains between French seaports and our supply bases behind the fighting front.

The task of our engineer officers and men in providing terminal and transportation facilities over here is complicated by many difficulties which railway operators or constructors in the United States do not experience. First of all, there are differences between French and American railway practice which must be adjusted before effective work can be done. It should be realized, however, that existing French main-line track is in good condition, available for the use of our rolling stock, and that tales of new four-track lines across France, to be built by American forces, are absolutely without foundation. The big problem is the terminal problem.

Differences in Practice

In the matter of main-line track gage the French roads are very nearly the same as our own, and slight adjustments in the wheel coning of our rolling stock will render it serviceable on French track. The French operating system, however, is left-handed, and certain track-construction details show variations from American practice. French rails, for example, are supported on chairs with a wedge knocked in to tighten them, while our rails rest either direct on the ties or on metal tieplates. French rail joints are placed opposite each other instead of being staggered. In the matter of curves the French work upon a scale of meters of radius, while American railway men deal in degrees of curvature.

As the first stage in the mapping out of the American railroad work our engineers have collected and are studying and redrawing to a new scale existing French plans. Here again new conditions must be faced. European methods of showing things on blueprints differ from our own, and all of the lettering, of course, is in French. Interpreters, to be sure, are available, but for the most part they are laymen, while the accurate interpretation of the data on the French plans calls in many cases for the services of technical specialists who understand both English and French engineering terms. Dimensions and quantities are in the metric system, and in the hands of men who have been dealing principally with feet, inches and cubic yards in their own work at home the French units are not so easily handled at first.

Much Preliminary Work

It therefore can be seen that before any large scale construction operations are possible a tremendous amount of preliminary work must be done in order to establish what might be called a uniform datum plane, from which effective coördinated effort must start. It is this preliminary work, this business of taking stock of existing facilities and fitting them into the plans for the future, that has been the chief task of our American railway and terminal engineers.

Just what the new work will involve can be stated only in rather vague terms. In addition to the railway yards and terminal structures there will be regulating yards whose function will be to preserve a proper balance of traffic between the storage yards and main-

line tracks leading to the front—a sort of compensating reservoir, to maintain a smooth, steady flow of traffic. Innumerable sidings will have to be built to hospitals, sawmills (where our forestry regiments will work cutting French timber), bakeries and various other structures. New engine terminals are included in the project, and connections must be made to our ordnance and munitions stores. The latter must be located at least half a mile distant from main-line track and buildings, and the type of construction, I am told, will be scattered units, in order to minimize the effects of explosions or bombing from enemy airplanes.

Dock and Terminal Structures

To get back to the railway terminal and dock structures, the freight classification sheds are to be long buildings 50 ft. in width with 8-ft. platforms and depressed track on the outgoing side. I asked the chief engineer what material would be used for these buildings. His reply was, "Anything we can get."

Ships will also dock in rectangular basins which, as built by the French, require entrance locks, as the variation in tide is considerable. Parallel to the sides and ends of these basins three lines of track will be laid where feasible and as much freight as possible will be unloaded with cranes directly from the ships' holds into cars. The remainder will be delivered to the classification sheds just back of the tracks which extend around the sides of the docking basins.

Some readjustment of the basin trackage system where existing docks are to be used will be required to adapt it to the use of American rolling stock. As now built, the tracks make right-angled turns at the corners of the basin and by means of turntables the French cars, on four wheels, negotiate changes of direction. Our freight cars, of course, will be carried by two four-wheeled trucks and will be too long for the turntables. This condition of affairs means the ultimate ripping out of the turntable system and a rearrangement of trackage to provide curves which our cars can negotiate, instead of right-angle turns.

For the terminal structures of various sorts tentative plans were prepared, and it is an index of the sort of things our engineers are confronted with to find out that many of these will have to be substantially revised on account of the low stresses which must prevail when certain French timber is used. For example, certain wood roof-truss designs based on the use of timber commonly employed for this purpose in the States are practically useless, for the lengths and the strengths of French timber are much inferior to those of American-grown material. I hear that it is impossible to get French timber piles more than 45 ft. in length.

Large Labor Force Needed

All of this railway and terminal construction program calls for a large labor force. Local labor, in so far as it can be obtained, will be used, but the bulk of the work must be done by men brought over from the States. In addition to the construction men there must be large quotas of stevedores. All will be under military regulation. On some of the English military projects great forces of Chinese labor have been employed. At the present writing the railway terminal and dock work is being done by United States troops of all kinds—marines, line troops and engineer units. When the labor battalions arrive from the States these men will be assigned to other duties. Among the wielders of pick and shovel in one of the temporary construction units is the son of a very wealthy man. "To think," he said, "that I had to get letters of recommendation from two men high up in official life at Washington to secure this job."

As for the operating end of the system which the American Expeditionary Force will control, its organization, according to what the general manager told me, will follow almost exactly that of the best large American railways, with general manager, general superintendent, master mechanic and so on down the line. There is one post to be created here, however, which has no counterpart in American railway practice. This is the R. T. O.—railway traffic officer. He was defined for me as a "100% man." Here are the constituent parts of this remarkable individual: "25% military, 25% French, 25% diplomat, 25% railway man." In addition, I was told, he must be able to work about 22 hours out of every 24. "It will be hard to find men of this type," the general manager continues: "In fact we are making plans now to establish a training school for them. There will be a number of these R. T. O.'s stationed at various points on the system, and to my mind the best raw material to work on will be a type represented by the highest class of station agent. The job of the R. T. O. will be to keep traffic moving and straighten out all difficulties which may crop up in his territory. Upon them will rest responsibility for teamwork with the French railway operators at important points of junction with the American system." The R. T. O. on military railways is a development of British methods of organization.

Citizens' Street Cleaning Bureau Quits

Due to the financial difficulties with which Chicago contends the Chicago Street Cleaning Bureau has ceased its street cleaning activities. This was a voluntary organization which handled an area of 120,000 sq.yd., or a large portion of the loop district. It was supplied with the city's quota of funds, augmented by an equal amount from private subscription of firms benefited. Definite standards of cleanliness were set by the bureau as described in the *Engineering Record*, Feb. 19, 1916, page 252. No dirt was allowed to lie on the streets more than 15 minutes. Richard T. Fox, general manager of the Citizens Street Cleaning Bureau, developed the intensive methods used.

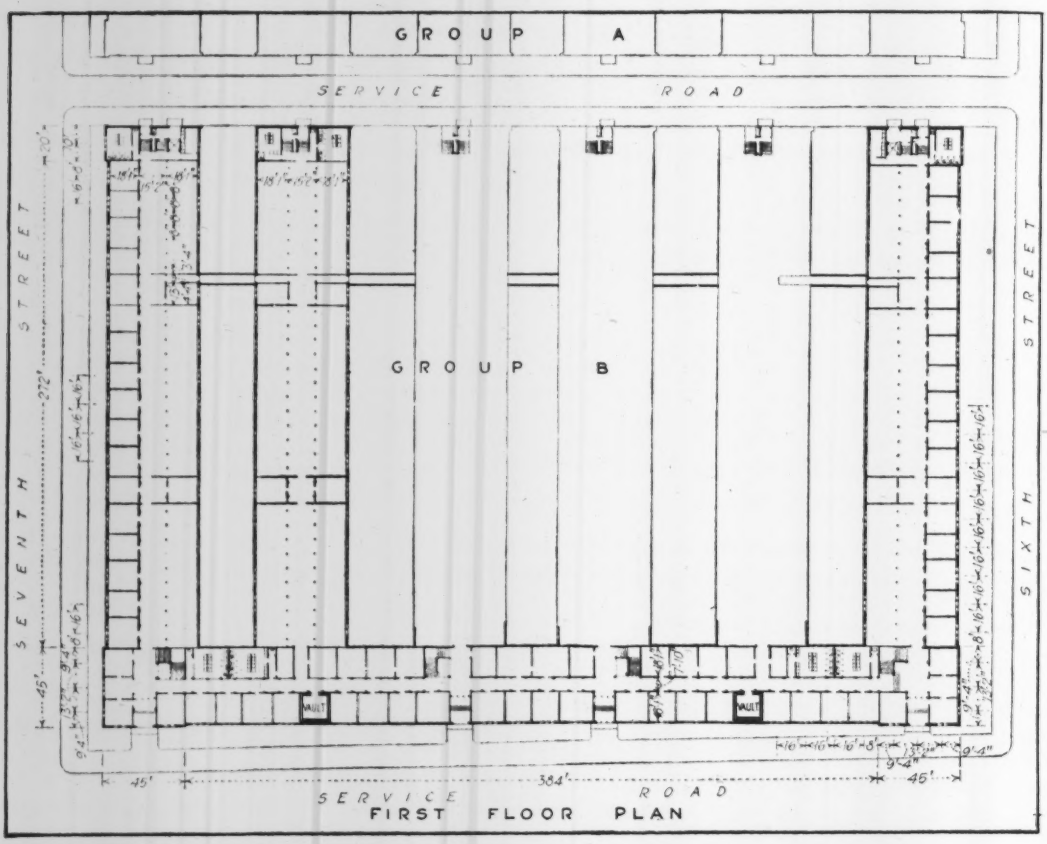
Minnesota Sanitary Plants Lack Attention

Operation of some of the 16 septic tanks, 32 Imhoff tanks and 19 water-treatment plants in Minnesota receives so little attention that in a number of municipalities they are becoming nuisances and endanger the public health. This is the conclusion of a committee on health and sanitation of the Minnesota Surveyors' and Engineers' Society which has had the list printed in its *Bulletin*, with the exhortation to discuss frankly the details of operation at the Duluth meeting Feb. 23.

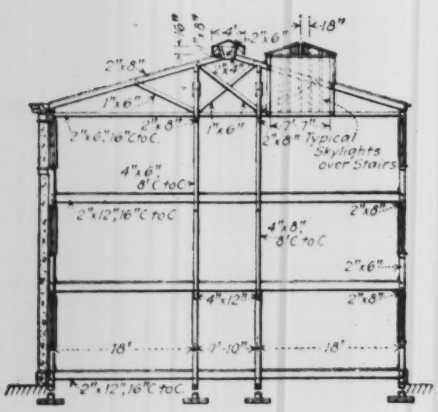
Three Wooden Buildings To Hold 10,000 Government Employees

Group of Administrative Offices, with Million Square Feet of Floor Space on Three Floors, Begun Oct. 11 and To Be Done in March, Already Partly Occupied

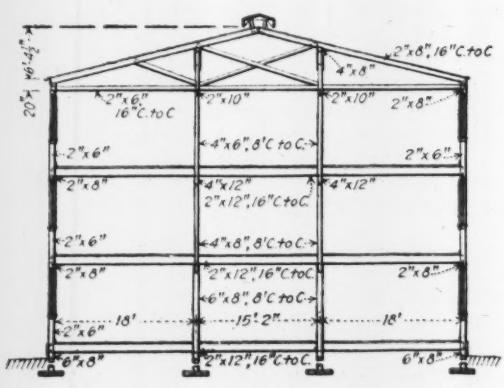
A GROUP of wooden office buildings for temporary Government use in Washington, D. C., requiring nearly as much lumber as a National Army cantonment, which was begun on Oct. 11 was one-third occupied by the first of the year and is expected to be completely in use by Feb. 15 next. The group, which contains more than one million square feet of floor space, comprises a heating plant, administration building and



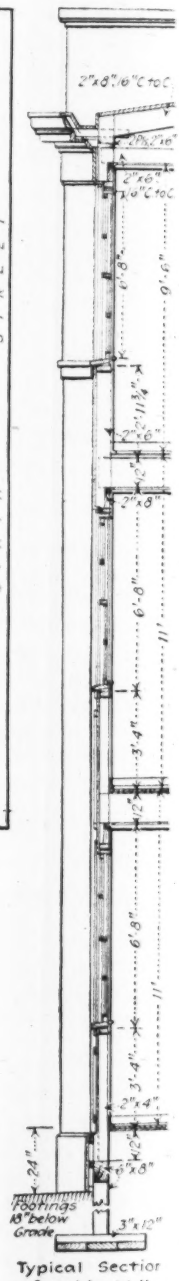
FIRST FLOOR PLAN



Section of Head House



Section of Wing House



Typical Section Outside Wall

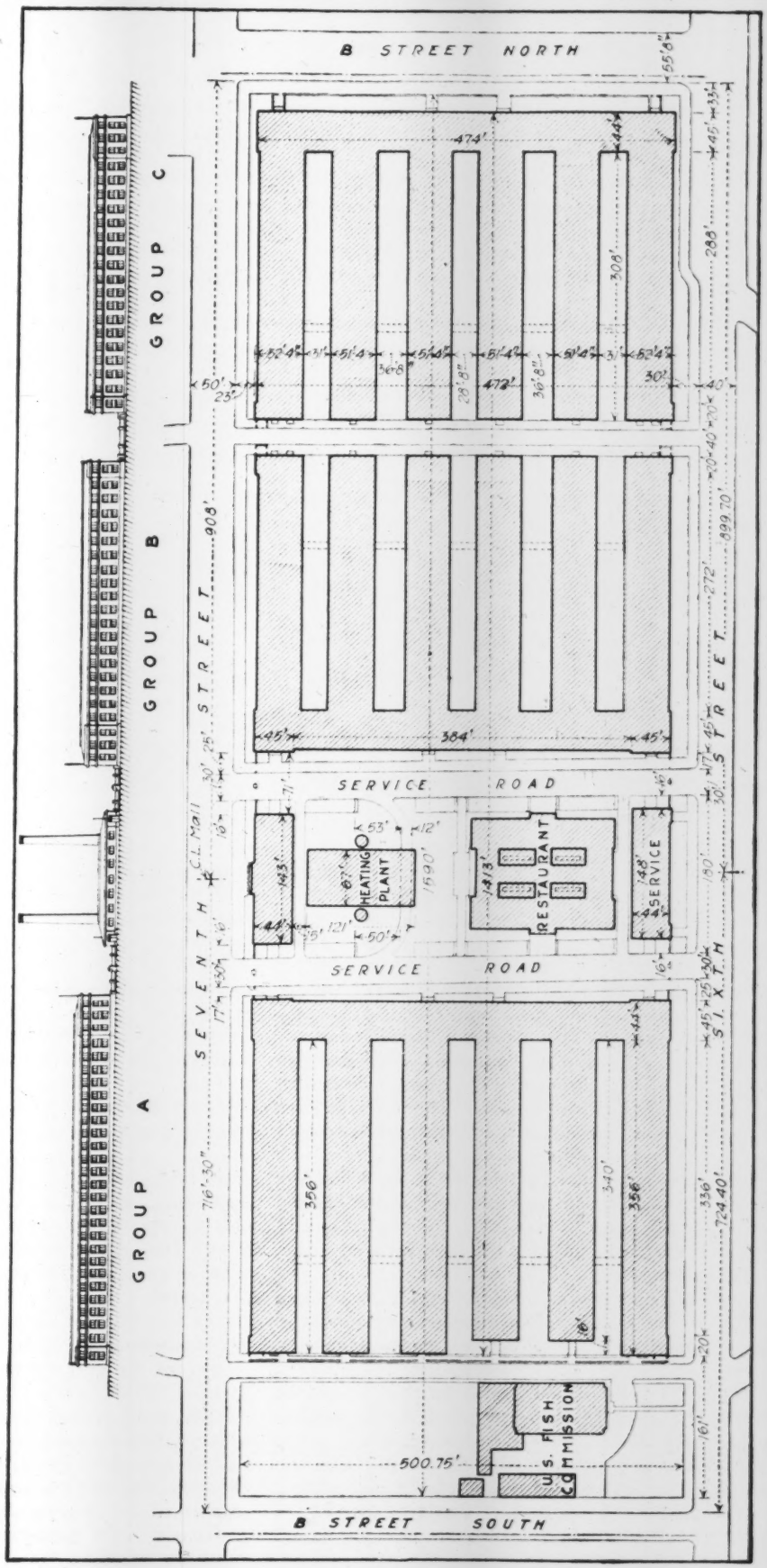
TIMBER DESIGN AND FRAMING, WITH STUCCO WALLS, GAVE SEMI-PERMANENT STRUCTURES

three 3-story main office groups, each of which consists of a headhouse 420 ft. long with six wings at right angles to it averaging 350 ft. in length. Arranged as shown in the plan, these buildings occupy a park which extends from Sixth to Seventh Street and from B Street North to B Street South near the site of the old Pennsylvania depot.

Group A is the one which was completed first, as less grading was to be done on this site, making it advisable to start grading with the steam shovels at B Street North, and work them south. For the same reason group B was next under way and group C was started last. Before anything beyond the grading of the last two units had been accomplished, however, work was begun on the 66 x 102-ft. heating plant on Oct. 26 in order that the first building might be heated as soon as it was ready for occupancy.

Groups A and B will be occupied by the Ordnance Department, while the Navy Department will take group C. The entire site will be inclosed, with the only public entrance through the administration building on Seventh Street. The employees, however, will use entrances provided at a number of other points and designated by their passes, which will be printed in different colors. There will be included within the inclosure a restaurant accommodating 800 people at one time, which is expected at luncheon time to care for about half the employees.

Wherever possible the interior of the large office buildings will be arranged with open railed corridors instead of with partitions, for economy, fire protection and ventilation. The buildings contain no passenger elevators, all occupants using the stairs. The floors of groups A and B are level throughout, but group C,



on account of the difference of 6 ft. in elevation between the Sixth and Seventh Street sides, has breaks in the floor levels, which are taken up by ramps and stairs.

All of the studding, framing, sheathing and underflooring is wood. The framing rests on creosoted 8 x 8-in. posts, each bearing on a grillage of 3 x 12-in. plank, also creosoted. The outside walls, to reduce the fire risk, relieve the appearance of the buildings and increase their serviceability and comfort in cold weather, are made of stucco placed by hand on metal lath tacked to the studding after the latter has been covered with one thickness of building paper inside and out. To further reduce the fire hazard, the end walls of the wings in groups A and B are made of hollow tile with stucco on the outside. The interior wall and ceiling finish consists of plasterboard nailed to the studding and the under side of the joists. The roofs are of felt, and

The lumber, of which more than 8,000,000 ft. will be used, has been received by rail at a yard near Fourteenth Street about one mile from the site. It arrived at the rate of twenty carloads or more a day. Operating over the 2-mile round trip between the buildings and the yard, motor trucks have been able to deliver steadily one carload each a day. The lumber was piled by sizes in the sidewalk space around the park, the walks having been closed to pedestrains. From these piles the lumber was taken to the portable sawmills, a dozen in all, strung around the building in the sidewalk area. After being framed in these mills the lumber was carried into the buildings by common labor to the carpenter gangs which erected it. The construction itself was similar to house building on a large scale, resembling the work done at the cantonments excepting that it was of a higher grade. The first floor joists and stud-

BUILDING AT RIGHT, GROUP A, FIRST STARTED BECAUSE GRADING WAS LESS AT NORTH

are partly concealed from the street by the corner parapets. In order to save the steps of employees within the group, the wings are connected at each floor level by bridges about 100 ft. from their outer ends. There are three fire risers in each wing of each building, and the entire group is equipped with automatic sprinklers, hand extinguishers and chemical engines being also provided.

Concrete foundations were required for the end fire walls and for the heating plant. They were placed with three small gasoline-driven mixers. The heating plant itself, which contains about 260,000 brick, has two 150-ft. stacks. The ten 200-hp. boilers which it contains supply 2700 radiators having 200,000 sq.ft. of heating surface. The coal bunkers are arranged so that loaded wagons can drive directly over them and discharge into them. The plant also contains the transformer station for lighting the group.

One railroad and one revolving shovel were used in the excavation work, the railroad shovel on the heavier grading where the cut reached as much as 10 ft. Eighteen motor trucks were used to take the material away from the large shovel, which reached an output of about 1200 yd. daily. The revolving shovel operated with 30 teams and loaded about 300 yd. a day. The excavation was general over most of the site, and was carried down to the sidewalk grade of the surrounding blocks, requiring the removal of about 35,000 yd. of earth.

ding extending to the third floor were put up in order, then the second floor joists, then the third floor joists and studding and finally the roof framing. The third floor studding was set up over a large area of group A by Oct. 25, two weeks after work started, although two days had been lost on account of rain. The first group was occupied and the remainder of the work completely framed and inclosed by the first of the year.

Closely following framing the flooring and roofing are put on, the metal lath and stucco being placed while the interior finish is being completed. The wallboard used is received ready to put up, being cut to size at the mills. The contractor has organized each of the three large buildings and the power house as an independent contract under its own superintendent, the entire work being under the Washington office of the firm. The contractor's organization is concerned only with the actual construction, materials being supplied and traced by the Government.

For this purpose advantage was taken of the existing organization in the War Department which had served as the expediting branch of the cantonment division. Dealing directly with the Carolina Pine Association, from whose members the lumber had been ordered, this organization took unusual steps to assure the prompt delivery of lumber. As soon as one of the mills reported the loading of a shipment a man was sent to ride it through to Washington. A similar organization with headquarters at Pittsburgh supplied

men for riding shipments of tile and other materials from the West. These men had orders to get the material to Washington, and no excuses or delays were considered. As a result a steady flow of materials was secured and the construction organization has been kept busy at high speed.

The unusual quantities of supplies bought, delivered and used in the buildings is indicated by some of the figures. The orders included 7500 double-hung windows with frames, shipped from Iowa; 30,000 lb. of sash weights; 1,000,000 ft. of tarred felt for subfloors; materials for 65,000 sq.yd. of exterior plastering, and 6 carloads of nails.

The organization at the site reached a maximum strength of 3400 men. The work was carried on by the George A. Fuller Co. as general contractors on a percentage basis, with the W. G. Cornell Co. as sub-contractors for the mechanical equipment. All engineering and construction work is being carried on under the general supervision of F. F. Gillen, with William Wooley as superintendent at the site, from plans prepared by Horace W. Peaslee, architect, under the direction of Col. C. S. Ridley, in charge of the Office of Public Buildings and Grounds.

Motor Truck vs. Rail for Handling Road Metal

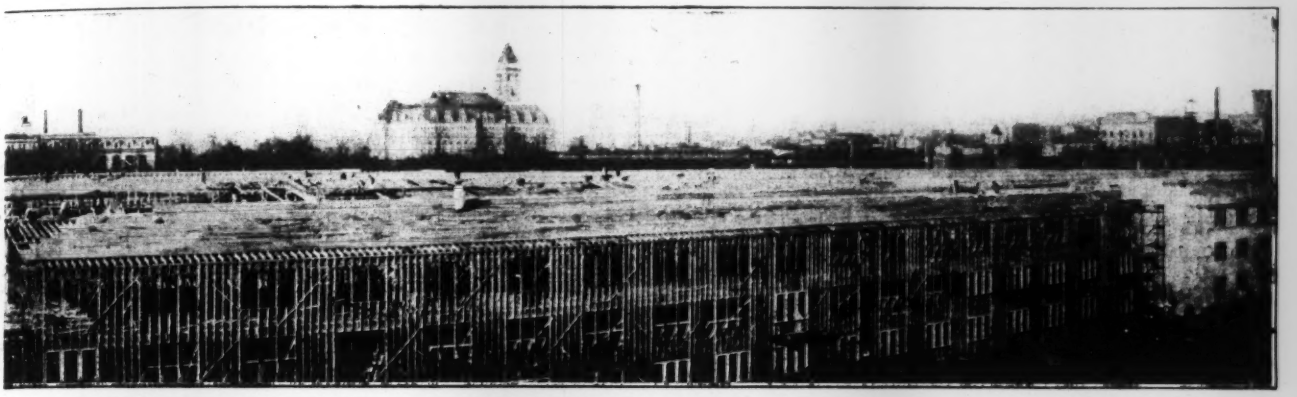
Since the embargo on gondola cars for handling road materials, the Los Angeles County Road Department has found it necessary to transport a considerable amount of material urgently needed for maintenance work. Bids were accordingly invited for the conveyance by motor truck of 6000 tons of decomposed granite. Inasmuch as well-paved highways extended for the entire 8.6 miles over which the material had to be moved, it was considered that the cost of hauling by motor truck should be comparatively low.

Four bids were received for this work. The successful bid was submitted on an alternative plan of 10½c. per ton-mile, or at the rate of $2.57 per hour per 6-ton truck. The hour rate guaranteed four round trips per day of 9 hours, making the total distance traveled 68.8 miles per day. At the rail rate the cost was 60c. per ton, and when hauled by motor truck on the ton-mile basis, which was the one accepted, the cost worked out to about 90.3c. per ton. Trucks are now delivering about 110 tons per day.

Will Cost Half Million To Make Austin Dam Usable

D. W. Mead Advises City That the Partly Rebuilt Dam Still Is Defective in Foundation and Superstructure

THAT the Austin dam, of unfortunate history, is in danger and will require the expenditure of $573,000 to make it safe and available for use is the finding of Daniel W. Mead, consulting engineer, who was called in by the City of Austin, Tex., to investigate the conditions. After reviewing the defective foundations, the possibilities of sliding, the present leakage, and the unfavorable character of the river bed, Mr. Mead arrives at the conclusion that "there is a real danger of the destruction of the old portion if it is allowed to remain in its present condition."



END, INCREASING TO TEN FEET IN SOUTH SECTION. HEATING PLANT IS IN FOREGROUND

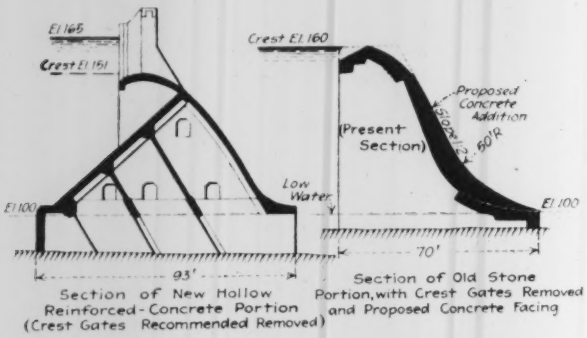
The history of the Austin dam on the Colorado River is a chapter of mishaps due in part to engineering conditions, but also to faulty promotional and financial methods and the interference of city officials with the engineers. A solid masonry dam built as a municipal enterprise was completed in 1893. It was 1275 ft. long, with a 66-ft. base and 60-ft. height above low water. In April, 1900, part of this dam failed by sliding downstream. In 1911 the city granted a franchise for a dam and water-power plant. The company holding this franchise filled the gap by building a hollow reinforced-concrete dam. This had its crest 9 ft. lower than that of the remaining part of the old dam, and both sections were fitted with crest gates to bring the maximum pool to a level 6 ft. above the crest of the old dam. The floods of 1915 carried out some of the gates, filled the raceway and caused other damage.

Acceptance of the work by the city was refused until various defects should have been remedied. Changes from the plans were discovered, and new leaks developed. Funds for additional works were not available, and the contractor had to make an assignment. The power company was deeply involved, and finally a receiver for the property was appointed by the court.

Mr. Mead's report (an illustrated volume of 214 pp.) states that for two years practically nothing has been done toward completing the plant, though some ex-

aminations and reports have been made. In May, 1917, the city council authorized the employment of an engineer to examine the conditions. Mr. Mead was engaged for the purpose. He was instructed to report on the stability and efficiency of the dam and to indicate necessary changes or improvements of the structure, so that the city might have full knowledge of the conditions in case it should desire to purchase the work or to insist upon the execution of the present contract.

Primarily, according to Mr. Mead, the foundations and superstructure need extensive repair. At the heel or upstream side of the dam thorough grouting of the foundation rock is necessary. In addition, a cut-off



CONCRETE SECTION SHOULD HAVE CREST REMOVED AND MASONRY SECTION STRENGTHENED

wall should be built above the new portion of the dam, being made 15 to 30 ft. deep according to the effectiveness of the grouting. A similar wall at least 10 ft. deep should be built above the heel of the old portion, unless the grouting is found to be thoroughly effective. If the leaks under the new portion are not stopped by this work, they must be shut off by still deeper and more thorough grouting at and adjacent to the fissures where these leaks now appear. In any case these fissures should be well filled with grout, mortar or concrete to a depth of 15 to 20 ft.

Depressions in the river bed below the toe of the new portion (hollow dam) must be filled with concrete, forming an apron heavy enough to prevent further scour by flood. This filling must be carried up to an elevation above the footing of the cross-walls so as to give them a substantial bearing and resistance against sliding. In front of the old section (solid dam) a 50-ft. apron is desirable, but possibly not essential at the present time if the bottom is watched and repaired whenever indications of erosion appear.

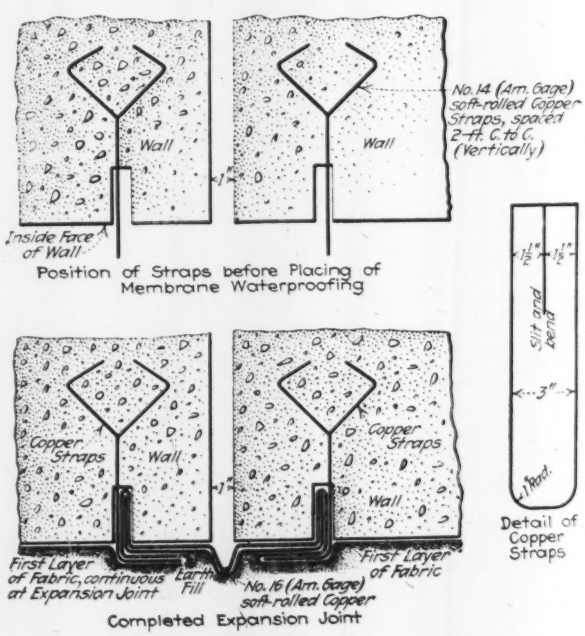
As to the dam proper, crest gates and piers on the new portion of reinforced-concrete hollow section should be removed and the crest raised 9 ft. to the elevation of that of the old structure, from which the crest gates should also be removed so that the maximum pool will remain at the elevation of the original dam. Crest gates to raise the elevation 6 ft. above that of the original crest level of the dam are not recommended, as the increased power would not warrant the additional expense. Mr. Mead considers that the most economical development will be given with the original crest elevation. The construction and maintenance of gates at this dam would be an expensive matter irrespective of their design.

During the construction of the apron, the inside of the new part of the dam should be cleaned out and the bottom examined for signs of additional leaks. The old solid masonry portion should have the foundations and body filled with cement grout, and be strengthened by the addition of concrete on the downstream face and toe, as shown in the accompanying drawing.

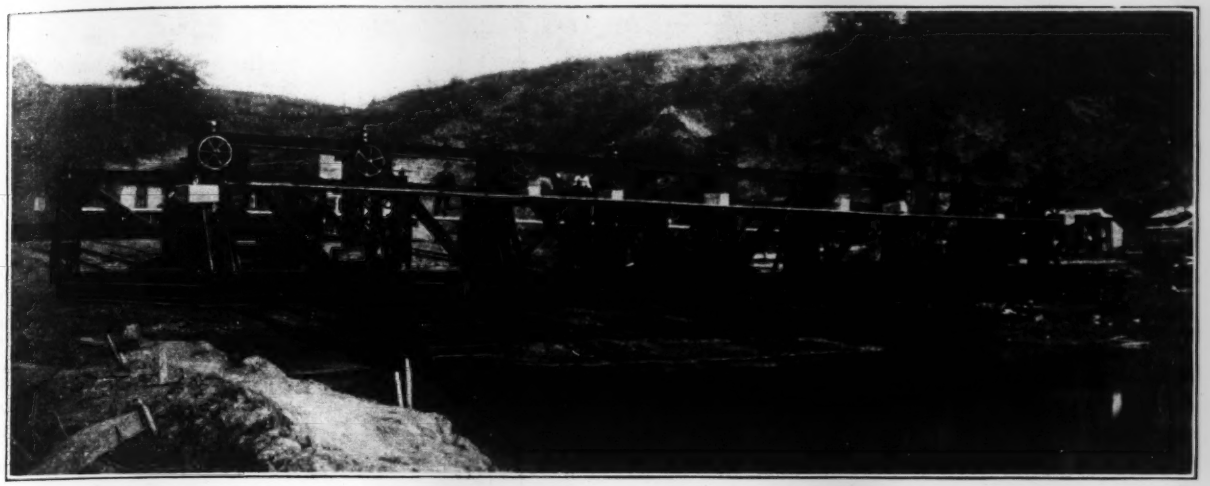
Other work which is necessary includes the checking of seepage around the west end of the dam, repairing the sluice gates and sluiceways, making the headgate masonry water-tight, rebuilding the headgate trash racks, clearing the tailrace, and excavating sufficient rock to give the water from the draft tubes a free discharge and a maximum velocity of not over 3 ft. per sec.

Watertight Expansion Joint Designed for Concrete Retaining Wall

FOR the concrete retaining walls of the new Hill-to-Hill bridge at Bethlehem, Penn., Harry J. Finebaum, assistant engineer to C. W. Hudson, the consulting engineer, has designed an expansion joint which it is thought will permit the movement of the sections of the wall and at the same time prevent the water in the fill from making its way to the face of the wall with consequent discoloration and cracking of the structure. The joint is shown in the accompanying drawing. It consists of two pieces of copper held in the concrete by lugs made by bending back the split ends of each piece and placed on each side of the joint with one end projecting, through a groove in the concrete, beyond the inside face of the wall. These protruding ends are then bent over to hold a copper flashing piece across the joint between the sections in the wall. Flashing and straps are bound together as shown with the waterproofing fabric, against which the fill is placed.



NEW EXPANSION JOINT MAKES RETAINING WALL WATERTIGHT



CRADLE OF BOAT INCLINE READY TO ENTER THE WATER

Cable Inclines Carry Boats Over Illinois River Levee

Electrically Operated Marine Railway Eliminates Necessity for Lock Connection—Turntable at Top of Bank Reverses Cradle

TRANSFER of river barges and boats across an embankment nearly 30 ft. high is a condition necessitated by the construction of a levee which closes the channel formerly connecting the Illinois River with Spring Lake, about 30 miles below Peoria, Ill.

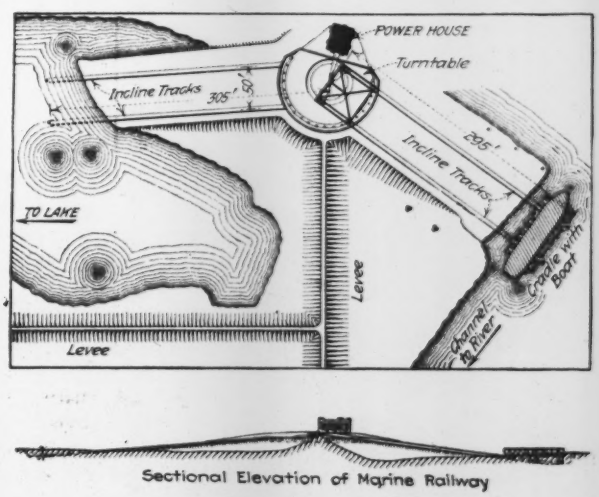
Flood protection for about 14,000 acres of overflow land along the river, by the construction of this levee, was proposed by the Spring Lake Drainage and Levee District. Protest against the closing of the channel was made on the ground of the lake being a navigable body. This was upheld by the courts, which required the district to construct and maintain works for providing communication between the river and the lake. A lock was found to be too expensive, both for construction and maintenance. A cable incline of the marine railway type was suggested, and this was adopted after having been approved as affording adequate service for the navigation interests.

This marine railway consists of two inclines on opposite sides of the levee, with their center lines at an angle of about 135°. On the incline tracks travels a boat carriage or cradle. This descends to the ends of the inclines to receive or discharge boats, its floor being submerged to permit the boat to be floated on or out of the cradle. The heads of the inclines are connected by a turntable, which swings the cradle from one to the other. In this way the side to which the hauling cables are attached always faces the power house at the summit.

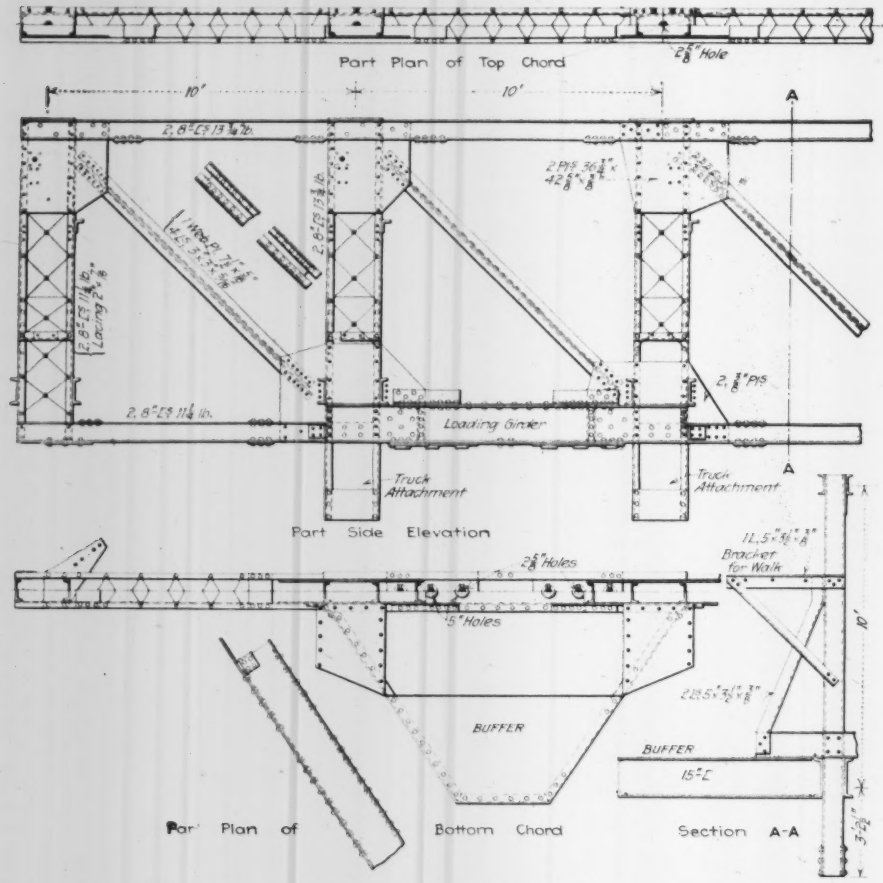
Each incline is about 300 ft. long, on a grade of 10%, and has two standard-gage tracks spaced 50 ft. c. to c. These tracks are laid with 120-lb. T-rails on creosoted ties 6 x 8 in., 10 ft. long, spaced 16 in. c. to c. and bedded in coarse sand which is 12 in. deep under the ties. The ends of the inclines are submerged in dredged channels leading to the river and the lake. The maximum vertical lift is 27 ft.

The cradle or boat carriage has a pair of through trusses 80 ft. long and 10 ft. deep, spaced 32 ft. c. to c. These are connected by floor beams, each composed of a pair of I-beams riveted against the sides of the posts. Diagonal bracing extends under the floor beams. The truss chords and posts are composed of pairs of channels, laced over the flanges. The post channels fit between those of the chords, and large connection plates provide for riveting up the chords, posts and diagonals.

Adjustable floor beams or boat beams suspended from the top chords form a deck which carries the boat during its transit over the inclines. These are rectangular box girders which fit between the pairs of fixed I-beams of the floor system. They are carried by suspension rods placed inside the posts and having threaded ends which pass up through bearing plates on the top chords. At



PLAN AND SECTION OF MARINE RAILWAY FOR TRANSFERRING BOATS ACROSS LEVEE



TRUSS DETAILS OF CRADLE

each end of the beam is a vertical cable leading to a hand-operated drum in the truss and carrying a concrete counterweight block.

When a boat is floated into the cradle and over the submerged floor the boat beams are first raised by the handwheels operating the cable drums. Then split nuts fitted with handles are clamped on the threaded rods, and are turned by hand so as to bring the beams to a firm bearing against the hull, thus taking the load. The boat beams are made watertight so as to have some buoyancy and thus facilitate the work of raising them into position. Use of the cables for the greater part of the hoist and of the nuts for the final hoist makes a considerable saving of time. Plank walks on brackets outside the trusses are provided for the operators.

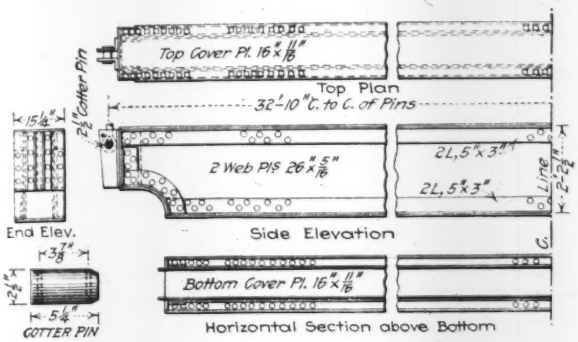
The boat carriage is mounted on a pair of eight-wheel trucks with 33-in. wheels and having frames built up so that the floor of the carriage is level. Each truck has brakes which can be applied by hand and are applied automatically in case of breakage of the haulage cables. To each truck is attached a 1½-in. steel cable which is led over 5-ft. sheaves on the turntable at the head of the incline and thence to the 5-ft. hoisting drum. Attachment to the truck is made by a heavy drawbar with coil spring. Release of the spring by slacking of tension of the cable will set the brakes on the wheels. The normal speed of the cradle is 16 ft. per. min. The weight of the boat-carriage or cradle empty is about 55 tons, and the loaded weight with the largest boat is about 400 tons.

Transferring the cradle from the head of the ascending incline to that of the descending incline is effected by means of a turntable or pivoted transfer table about 56 x 57 ft. which swings through the angle between the center lines of the inclines. A vertical pivot at the rear end and corresponding with the intersection of these center lines forms the center around which the table swings. At the front end of the table is a concrete curb wall, but the pit is open at the rear.

CRADLE BEING MOVED UPON TURNTABLE FOR TRANSFER

Each side of the turntable consists of a pair of plate girders about 54½ ft. long and spaced 5 ft. apart, the two pairs of girders being 50 ft. c. to c. Other plate girders form the ends of the table, and diagonal braces extend across the inclosed space, with a strut from the pivot point to the intersection of the diagonals. The side girders are 48 in. and 22 in. deep at the rear and front ends respectively, and are inclined so that their top chords have the same 10% slope as the inclines. No deck or floor is built on the table.

Wheels under the ends of the side girders support the table and travel on two concentric tracks on the floor of the pit. Swinging cables are attached to the trucks at the outside corners of the table, and are led around guide sheaves along the center of the outer track. From the ends of the arc formed by this track the cables run to guide sheaves outside the power house and thence into



BUOYANT BOX GIRDERS SUPPORT BOAT ON CRADLE

the house and to the 36-in. hoisting drum. The end of the table travels at about 20 ft. per min.

Two tracks on the table are carried by the pairs of side girders and register with those of the inclines. The haulage cable attached to each truck of the cradle passes down over a large vertical sheave mounted at the rear end of the table track and around a horizontal guide sheave which leads it out through a hole in the web of the inner girder. From these side sheaves the two cables pass to horizontal sheaves over the pivot and then out through openings in the rear girder, from which they lead to the power house. Midway between this house and the turntable pivot they are supported by a pair of horizontal guide sheaves mounted on a concrete pedestal.

Electric power is used for operating the machinery, current being taken from a 13,000-volt transmission line 20 miles long, which also serves two drainage pumping plants. A 75-hp. motor drives the drum of the cradle hoist, and an 18-hp. motor drives that of the turntable cable. A powerful band brake on the hoist is controlled from the operating platform and will be applied automatically if the cable should start to unwind or overhaul, if the cradle speed should exceed 16 ft. per min. and if the current should be interrupted. On the operating platform are a speed indicator, a diagram with pointer showing the position of the cradle during its travel, and a circular dial with pointer to show the movement of the turntable.

The Spring Lake marine railway was designed by the Elliott & Harmon Engineering Co., of Peoria, Ill., as engineers for the Spring Lake Drainage District. It was built by the John T. Walbridge Engineering Co., of Chicago. The cradle and turntable were built by the Milwaukee Bridge Co., of Milwaukee, Wis., and the operating machinery by the Connellsville Mfg. & Mine Supply Co., of Connellsville, Penn. Electrical equipment was furnished by the General Electric Company.

Engineer's Story of Building Dam

Describes Various Steps Taken in Making Earth Fill with Concrete Core-Wall Pierced by Concrete Conduit

THE construction of an earth dam on Phelps Brook for an additional water-supply for Hartford, Conn., was described at the November meeting of the New England Water-Works Association by J. F. Shaughnessy, assistant engineer. The dam is of earth with a concrete core-wall, and a reinforced-concrete conduit is built through it. An abstract of Mr. Shaughnessy's paper, which is an engineer's story of a construction job, follows:

After diverting road traffic around the dam and providing a flume 12 ft. wide, 4 ft. deep and 400 ft. long to carry the stream flow, excavation for the conduit trench was begun. About two-thirds of this was in rock, the foundations for both gate chambers being included in this portion. Blasting was necessary for a distance of about 100 ft. In order to guard against opening up the already seamy rock, light charges of 40% dynamite were used in shallow holes. Near the bottom of the trench loose pieces were barred out.

All surfaces not showing clean were gone over thoroughly with picks, to remove anything that would prevent actual contact between the ledge and concrete to be poured above it. After a scrubbing with water and wire brooms a coating of dry cement was spread, about one-fourth bag to the square yard. This was then wetted to the consistency of thick paint and brushed in with wire brooms. On this was placed a thin coat of mortar consisting of one part cement to three parts sand. The pouring of the concrete was immediately started on this prepared surface.

The conduit is of horseshoe shape, 6½ x 6½ ft. inside measurement, 10 to 18 in. thick, according to the depth of cover. The longitudinal reinforcement was 1-in. twisted steel bars about 12 in. apart and 3 in. from the inner and outer faces. Similar reinforcement was used circumferentially for the arch, the two being tied together.

The forms for the invert and the outside of the conduit were of wood and were built as the work progressed. For the inside, Blaw metal forms were used. Both metal and wooden forms received a coat of form oil before any concrete was placed, and during the pouring the concrete was spaded to assure a smooth surface after completion. Special spades were made for use in the arch, to enable the workmen to reach between the reinforcement rods.

Contraction joints were provided every 25 ft., ingot iron water stops being inserted at each joint. The ends of the sections first built were made smooth, except that 4 in. of 8 x ⅜-in. iron were left protruding. Before the adjacent sections were started these ends were

coated with asphaltum paint. The outer ends of each section were treated in like manner, making every 25 ft. a joint that was virtually watertight.

While the building of the conduit was under way the excavation of the core-wall trench was carried on, the deepest part being about 30 ft. below the level of the brook at a point 150 ft. south of the conduit. The material in this cut consisted principally of fragments that had been broken from the ledge, with some silt washed in from the valley above. It was removed by clamshell and orange-peel buckets.

After the material above the ledge and along the line of the core-wall had been removed and the grouting done in the low section, the building of the core-wall was begun. A section 30 x 21 ft. was cleaned, and cement and mortar were applied, as already described in the case of the conduit.

The core-wall was built 8 ft. thick up to the elevation of the brook, 430 ft. above sea level, and tapered to 2 ft. thick at the water line, Elev. 485. From Elev. 485 to 490 the thickness is 2 feet.

At the bottom of the core-wall are two aprons, one extending 10 ft. from the upstream and one extending 3 ft. from the downstream face, making in all a 21-ft. contact between the ledge and the concrete. These aprons were built to such a height that at any point the ledge was covered with at least 3 ft. of concrete.

The forms for the sections in contact with the ledge were generally built of wood, as this material could more easily be made to conform to the varying shapes of the rock encountered. Above the first lifts, Blaw forms were used. These forms were made of channels, each side consisting of three parts—a center piece 36 in. deep with a 6-in. piece bolted on either side. Through the center of these 6-in. channels and at intervvals of 5 ft. were passed ¾-in. rods. Struts cut to a length equalling the thickness of the core-wall kept the forms at the proper distance apart, while a setscrew on the rods outside the forms prevented spreading. In each completed lift the upper channel was allowed to remain in place and become the lower channel of the form for the lift above.

At the end of each 30-ft. section a contraction joint with water stop is provided. The water stops are placed in grooves varying in size from 4 x 30 in. to 3 x 16 in., according to the thickness of the wall. In the middle of each groove was inserted 4 in. of the 8-in. water stop. These contraction joints were begun at the ledge and carried vertically to the top of the wall. The ingot iron is given a 6-in. lap and is bolted wherever joints are broken.

Three keys were inserted at the top of each layer while the concrete was fresh. Two rows of keys were fastened to the forms, leaving grooves 4 in. wide on the bottom and 8 in. wide on top. The center groove was triangular, 8 in. wide on top. All grooves were 6 in. deep.

The gravel composing the outer portion of the dam was rolled in layers not exceeding 1 ft. in thickness, and the loam between the gravel and the core-wall was rolled in layers not exceeding 8 in., or tamped in layers not exceeding 4 in. At the bottom of the deep cuts it was impossible to use the rollers on account of lack of space, so puddling was substituted for rolling.

Flood Floats Road Guard Railing

By C. P. Mowry
Office Deputy Engineer, King County, Washington.

During the recent floods in the lower valleys of King County, Washington—the worst experienced since the system of modern highways was begun—an unexpected weakness was developed in the massive timber embankment rails which have been standard construction in the county for several years. These railings are built of straight peeled fir logs, 10 in. to 14 in. in diameter with scarfed end joints adzed to a bearing and drift bolted to the tops of heavy cedar posts, and spaced 8 ft. centers. These posts are set into the ground to a depth of about 3 ft., the whole structure being designed to give protection both mental and physical to the motorist driving along high places.

For a week or two a considerable portion of the paved road between Seattle and Tacoma was under water to

GUARD RAILING RAISED WHEN FLOOD FLOATS TIMBER DESPITE GROUND FRICTION OF POSTS

a depth in places of several feet, and the bouyancy of the railing proved to be in excess of the frictional resistance of the surrounding earth. As is indicated in the accompanying photograph, considerably more than a mile of railing was raised in this manner, in some instances enough to float the entire structure away and lodge it against the fence at the side of the right-of-way.

In resetting the rails it is proposed to spike to the lower part of each post a piece of 3 x 8-in. timber 2 ft. long. Farm fences in the vicinity built with the posts similarly treated went through the floods without serious injury, while those built in the ordinary manner were generally destroyed.

The work of repairing all flood damage to the permanent highways and all bridges within the county is being carried out by the forces of the county engineer, Samuel J. Humes.

Complete One-Hundred-and-Twelve-Mile Paved Road

With the completion and opening of the concrete-paved road between Duwamish and Renton Junction, Wash., there is now completed a paved highway 112 miles long, extending from a point near Olympia, Wash., to Marysville, in Snohomish County. This is part of the so-called Pacific Highway.

Common Use of Records of Minimum Stream Flow Is Pernicious

Minimum Flows Not Considered in Fixing Size of Power Development; May Indicate Weak Report or Ulterior Purpose

By George F. Ladshaw
Consulting Hydraulic Engineer, Spartanburg, S. C.

THE record minimum flows of streams (for 1904 in this district) are discussed in so many recent engineering reports on power development that the reasons for such action demand comment. For a long time the writer has hesitated to offer the following remarks, hoping that the abuse would be discontinued as general public knowledge of hydraulics increased. But it is necessary to speak, for the practice still is rampant, interfering with economic development, entailing an immense amount of unnecessary work on engineers, and breeding doubt and dissatisfaction among business people.

The developments exist in contradiction to the reports. No water-power property would be worth development if these low-flow data were used in preparing designs. Why, then, a discussion of data that never reaches the power house? In the absence of exact knowledge it becomes necessary to presume rational bases for the inclusion in engineering reports of data that are expunged in making designs:

First, these records are dwelt upon by young men, only just knocking at the door of notice and experience, who mistake volume of data for depth of treatment.

Secondly, such data are paraded to exert influence for some ulterior purpose.

Some Questions Interjected

Some pertinent questions suggest themselves: What water power has been developed considering abnormal minimum flow? Are all the technical developments failures, or are the artists who manipulate low-flow data only "bunco-steerers"? Would any promoter agree to sell property basing the primary capacity on the record minimum flow and accepting a proportionate price for the excess capacity, after an allowance of 10% of the plant needed for regulation? Does not about 90% of plant capacity—barring draft on reservoir and backwater allowances—commonly represent the available marketable power? Are not the figures of abnormal minima often employed to derive "fake" values of plants, to discourage development, to yield subterfuges for opposing interests?

In the writer's practice, the size of a development not having seasonal storage (and seasonal reservoir capacity is generally unavailable on streams of over 50 sq.mi. drainage area, while on smaller streams it is usually cheaper to supplement with steam than to provide necessary reservoir capacity) is fixed by judgment after weighing the seasonal demands of the power market, after studying the daily variations in demand and the possibility of daily storage, and by finding that combination of hydraulic and steam plants that will develop the maximum power at a cost which the market will support. Minimum-flow data do not enter in.

The interplay of complex natural phenomena back of record low flows is an interesting subject which it is well to study to learn whether ignorance or mischief is the cause for the undue display of minimum-flow data. So far as design goes, however, the following discussion is rather academic.

In hydraulic-power studies a calendar year constitutes a complete cycle of events, varying in degree only. Acceptance of a tendency to recurrent phenomena in nature and a scientific basis for all events imposes expectation of a cyclic character for minimum rainfall; but meteorological science shows an element of chance in the rainfall coupled with the tendency of nature to "even up" within short periods. It is evident the normal rainfall in any section is due to continental and physical conditions as yet little known, but the variation in amount from year to year is a matter of chance and subject to investigation according to the doctrine of probability as used by actuaries.

Normal Rainfall Average of Years

The normal rainfall for any section is the average for a number of years. Computation of this average could be improved by least-square treatment. The rainfall is the only source of the flow of streams. The flow of streams, run-off, varies directly with the rainfall, modified principally by ground storage and forest conditions. The flow of a stream during a year of normal rainfall is a normal flow, modified by ground storage. More water discharged than accounted for by a normal rainfall is due to ground storage. The power or developed flow of a stream for twelve months is ordinarily greater than a normal flow.

The normal flow of streams is directly proportional to the normal rainfall modified by geologic structure and forestation; and the normal flow of any stream can be determined from the rainfall on its basin or on a similar basin where the rainfall or flow is known. The flow of an ungaged stream is determined by comparison with the daily records of a gaged stream of similar conditions. That is, similar conditions in drainage areas produce similar flow. In comparing the flow of gaged streams to determine the flow of an ungaged stream, the rainfall must be approximately the same, as well as drainage area, geologic structure and topography. Quite often the elevations above sea level should be approximately the same and the areas contiguous. The conditions are given in the order of importance. The government daily records of rainfall and stream gagings afford voluminous data for the discussion of stream flow in hydraulic-power development.

The writer has records of local fluctuations of ground water for over twenty years, 1894-1916, and in making studies of everything supposed to be relevant found that fluctuations in ground water did not agree with the rainfall as light or heavy, but finally deduced the important principle that the fluctuations are directly proportional to the duration of the rainfall—not the amount.

Forty-year records of rainfall in this district, corrected for local excesses and deficiencies, show a minor cycle of seven years, in which four years are normal (variation 8% and less), two years are wet (variation, 8% excess and more), and one year is dry

(variation, 8 to 15% deficiency). The long-period minimum in this section is 26% deficiency. The records show that no order is maintained. The sequence of wet, dry and normal is mere chance.

From tabulating a cycle of events as observed to obtain the degree of variation affecting a yearly period it is found that wet, dry, and normal, are more particularly applicable to seasonal periods, and frequently extend beyond a yearly period in which the rainfall strikes a balance as between any two successive seasonal periods. That is to say: A wet following a dry period balances to give a normal condition. But in hydropower development there is greater interest in what happens when dry periods follow dry and normal periods. The periods within a calendar year are the same as given by Vermeule and Rafter (U. S. Water Supply Paper No. 80) except that the winter period is five months and the summer period is four months in this section.

It is well known that the ground-water reservoir of the streams sustains the normal, low-season flow for several weeks during a total absence of precipitation, and the rate of depletion is very slow. Streams frequently discharge an inch or more per month from the watersheds without addition of rainfall. This is particularly true of the summer period, when rainfall seldom affects the ground-water reservoir.

In the seven-year cycle investigated there were: winter period, 3 wet, 2 dry, and 2 normal years; summer period, 3 wet, 2 dry, and 2 normal years; autumn period, 3 normal, 3 dry, and 1 wet. This cycle includes the record minimum year, 1904. As general corollaries in stream flow, wet periods are independent events and normal and dry periods dependent events, as to successive influence. A regular order would be normal throughout a year but usually exceptional. Hence order is not a rule and combination in sequence of these events produces high and low water in the streams, but, through many seasons, a normal condition is maintained. Also, extreme low water always occurs during the third or autumn period.

Analysis of observations shows that any two dry or normal periods in unbroken sequence following any wet period reduces the stream flow to normal conditions only. Three or more dry periods in sequence produce abnormally low water and reduce the power available at any moment during the third dry period by 4% to 20% as the dry period continues.

Preceding the dry autumn period of the year 1904, there were successively one normal and three dry periods. During that dry autumn (which was the fourth period in the unbroken sequence) the power available dwindled by 39.48% of normal and the deficiency existed for 46.85% of the year (8760 hours). The deficit of the normal total annual energy yield then was 18.497 per cent.

For comparison, in the year 1907 the deficiency in power, as above, was 22.147% for 18.63% of the year and the deficit in total normal energy was 4.126 per cent.

As shown by observations, three or more dry periods must occur successively to produce an abnormally dry period or excessively low water. Hence, what is the probability that three successive dry periods will recur?

There are 21 events, $7w$, $7d$ and $7n$. Three successive d events equals $\frac{1}{3} \times \frac{3}{10} \times \frac{2}{19}$, or 3/114, or 38 to 1 against a triple succession of like events. The records of rainfall for 40 years and more justify this probability. To be exact, the tabulations prepared in making this study show one normal and four dry periods preceding the 1904 minimum flow, which would make the probable events much more than 38 years apart.

A deficiency in rainfall of less than 8% during any year, following wet or normal years, yields normal stream flow—the stream being sustained by ground water. Deficiency in rainfall of more than 8% and less than about 15% affects stream flow for power purposes to the extent of about 4% of the time of normal flow and amount of power available during one year. The greater percentage of deficiency succeeds a normal year or a dry winter, usually, and occurs once only in any 7-year cycle, as so far observed.

Curve diagrams, from records, for drainage area and sectional rainfall reduction, show a drop in rate of normal flow of 25% for between 150 and 500 miles drainage area, 50% for 1000 miles, and 70% for 5000 miles, rainfall being 50 to 65 inches per annum.

Hazardous Work Produced Few Accidents

Study of over 3000 accidents which occurred during the reconstruction of the Manhattan Elevated Ry. system in New York City for three-track operation shows that the most hazardous work did not produce many accidents. Very few fatal or other accidents occurred when those engaged on the work realized that special precautions had to be taken. Not a single accident happened on work that could be classed as extra hazardous. Replacing the three spans of the Harlem River Bridge, which work was done at night (and in the case of one span during a heavy snowstorm), was accomplished without an accident even of minor character, although the work was done at maximum speed to permit earliest possible resumption of traffic.

Over 70% of the accidents caused no loss of time to the employee hurt, and in only 12% of the total number was the employee away from work more than two weeks. Bruises, sprains and cuts made up 74% of the entire list; accidents to the eye, 10%; accidents caused by projecting nails, 6%; various minor causes were represented in the other 10%. With respect to the causes of the accidents the following figures are of interest: 56% were chargeable to the injured person himself, while 33% occurred when working with others; 4% were caused by falling material, 3% by failure of plant (this included the slipping of a ladder or the blowing out of the snap of a riveting hammer), 2% by trains and 2% by short circuits.

The work was carried on under special precautions to guard against accidents, although on the other hand it was necessarily of such character as to expose the men to an unusual number of mischances. The average for 3334 accidents, occurring during 1,060,000 single-man working days, is one accident per 318 men a day, as given by F. W. Gardiner and S. Johannesson in a paper entitled "Manhattan Elevated Railway Improvements," published in the December, 1917, "Proceedings" of the American Society of Civil Engineers, and presented Feb. 6.

New Shipyards Built on Canadian Pacific Coast

Types of Plants for Both Wooden and Steel Vessels Established Within Past Year in British Columbia

By R. Mackay Fripp
Architect, Vancouver, B. C.

As in practically every coast section of America, British Columbia is now developing a shipbuilding industry. A year and a half ago scarcely a vessel of tonnage greater than a tug or a ferry, a scow or a small yacht had been built in the province. Ships requiring anything approaching extensive repairs had to go elsewhere, even though the finest dock on the Pacific Coast is at Prince Rupert. The high price of materials coupled with the rate of wages rendered it impossible to compete with those places enjoying greater facilities and advantages in these respects. Today with the world-wide demand for ships, yards for the construction of both wooden and steel vessels are in operation or in course of construction. Of a dozen such yards in the vicinity of Vancouver there is given herewith the description of some typical layouts as an indication of the size and scope of the plants and of the principles governing their construction.

Some twenty years ago the parts of two or three small steel cargo boats were brought from Great Britain and assembled in Coal Harbour, B. C., but no serious effort was made in shipbuilding until the spring of 1916, by which time the shortage of tonnage was becoming acutely felt, particularly in the export-lumber trade. The Provincial Government offered encouragement to the construction of wooden auxiliary steam sailing schooners and a score of them were quickly under construction. They are built to one type, of 2550 tons dead weight and 1,500,000 ft. of lumber in capacity. Each has twin Bolinder engines of 360 hp. to give a speed of 8 knots. Many of this first group of ships have been launched and several have actually completed their first voyages.

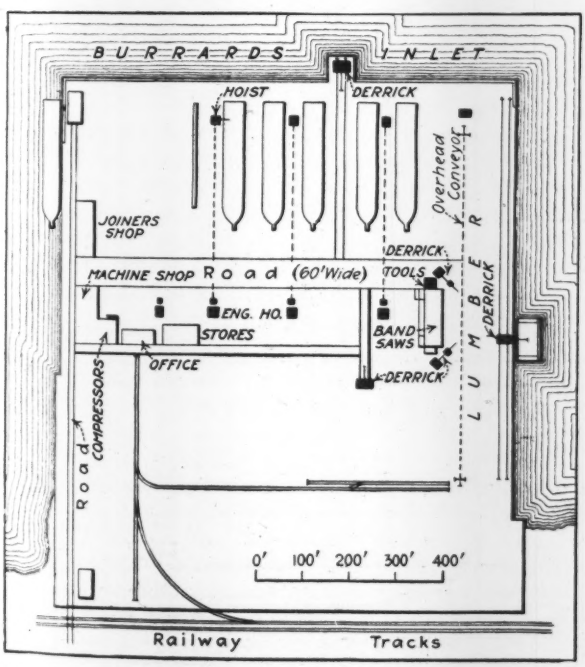


FIG. 1. LYALL SHIPBUILDING YARDS AT WEST VANCOUVER, B. C., A TYPICAL NORTHWESTERN WOODEN-SHIP YARD

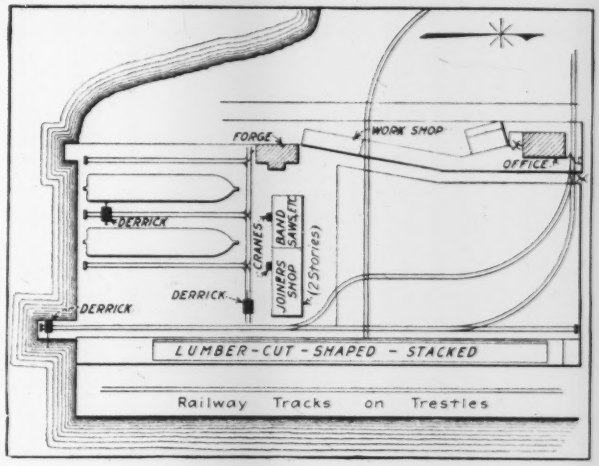


FIG. 2. ANOTHER TYPICAL WOODEN-SHIP YARD NEAR VANCOUVER, B. C.

Steel steam shipbuilding quickly followed on the first wooden shipbuilding program and on May 17, 1917, the first oceangoing steamer built in Western Canada was successfully launched from the Wallace Shipbuilding yards at North Vancouver. This was War Dog, a boat of 4800 tons dead weight, 315 ft. in length, 45 ft. molded beam, 27 ft. depth, and 6750 tons displacement. Engines designed and built in the yards gave her a speed of 10 knots.

The wooden-ship yards are, broadly speaking, laid out on the same general plan, a typical example of which is the Lyall yards near Vancouver, shown in Fig. 1. There is, for instance, a wide frontage to the sea or river with space sufficient for laying down the number of vessels required side by side, with a pier or wharfage for unloading waterborne material and a narrow-gage line or lines to carry it to the workshops, aërial conveyors or traveling derricks to distribute it where required when worked up and hoists to handle it at the respective ships. In every case the base of the yard is contiguous to railway trackage with a spur or spurs into the yard.

Facing the line of vessels is a row of machine shops and adjoining these are the compressors, usually three in number, for furnishing power to the compressed air tools. These consist of boring, drilling and turning machines, a plant for cutting, threading and heading bolts, and another for galvanizing. A model loft, pattern shops, a floor for templates and the drafting office are grouped together.

As compared with the plant for building steel ships, that for the construction of wooden vessels is simple. The massive timbers are unloaded from the scow by the traveling derrick on the wharf and stacked in the space between the lines of the derrick and the overhead conveyors which carry the material to the band-saw shops, where it is cut to the templets and swung over to the second traveling derrick and by it transferred

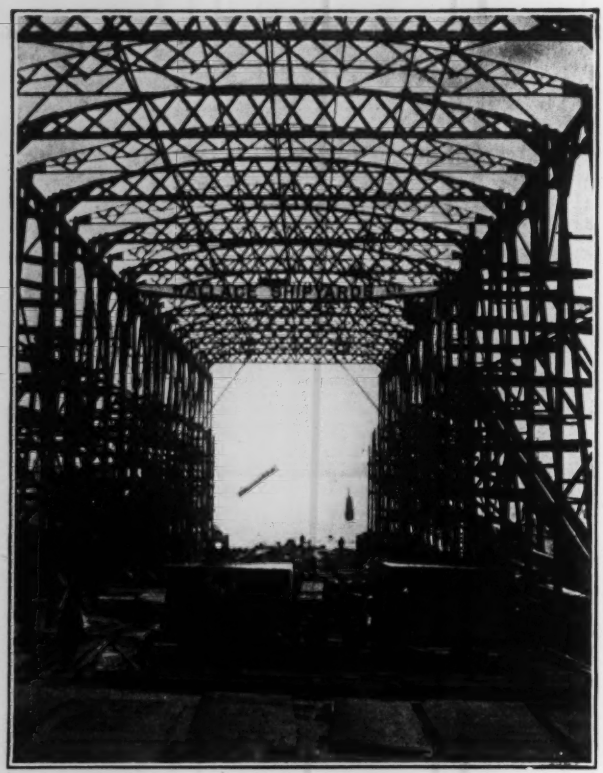


FIG. 3. CRANEWAYS BUILDING STEEL SHIPS IN WALLACE YARD IN NORTH VANCOUVER

to a third. It is then delivered to the ship cranes and hoisted into position.

Fig. 2 shows the layout by another wooden-ship yard, of slightly different layout from the Lyall yard, though the plant contained is practically similar. Where the lumber is brought to the yard on the cars it is stacked along the rails of the traveling derrick by which it is taken to the shops, the overhead conveyor in this case being dispensed with. This derrick also travels on tracks between the shipways which it controls.

Ample space is required for stacking the lumber upon delivery and again when shaped and prepared. A great deal of work is done in the open air by hand, such as the shaping of the massive rudder and bow pieces, and stern posts, scarving, trimming knees, etc., the preparation of the masts, yards and booms.

A much greater space is demanded for wooden shipbuilding in proportion to tonnage than for building in steel. In the latter yards materials require much less space. Plates are placed on edge in racks and passed with the minimum of handling to the punching and boring machines. A few months ago steel ships in this territory were "assembled" rather than built, but a complete change is being brought about. Though no steel is rolled in the province as yet, all shaping, cutting, bending, welding, casting, turning, boring, drilling and punching are now done in the shops of the yards. Engines are designed and built complete instead of being simply imported and set up.

The Wallace shipyard at North Vancouver (Fig. 4) is a good example of this type. Here a large runway with overhead crane is placed between two piers. The one to the west is for loading and unloading scows, and the eastern pier has a traveling derrick but has sheer legs as well at the pierhead and the pier is upon a greater scale and is carried out to deep water. Immediately east of the shipway with its crane, which is shown in the view, is a ship railway of 2500 tons capacity and parallel with that are the machine shops, smithy, shaping floor, furnace room and galvanizing plant in the order named. The offices and drafting rooms occupy a second story over a portion of the machine shops. Then comes ship railway No. 2, of 1500 tons capacity, and more wharfage where an extension of the machine shops is being made. The crane, it will be noticed from the view in Fig. 3, travels on light steel runways braced by overhead trusses.

North of the gantry extend the boiler shop sheds, punching and riveting shops, all beneath the same roof. The L-shaped building in the northeast corner contains joiner and carpenter shops and pattern rooms. The forge connected with these yards is on the Vancouver side of the harbor. The entire capacity of the yard is limited to the construction of one ship of 8800 tons and the simultaneous docking and repairing of two others, not exceeding 2500 and 1500 tons deadweight.

In the John Coughlan yards on False Creek six steel steamers aggregating 52,800 tons deadweight are in course of construction. The position is ideal, having a wide frontage on sufficiently deep and wide water with a bay and wharfage on the west side. The Great Northern Ry. tracks form the southern base. The building is carried on in the open, but one of the last ships laid down is to be covered in. The plant is arranged on three sides of a square of which the ships may be said to form the fourth.

The buildings facing the railway (see Fig. 5) are two-storied with a through entrance separating the office block from the machine shops, which extend across the balance of the front. Above the machine shops are the mold loft and templet rooms. The whole of the west wing is devoted to the preparation of the plates, which are unloaded at the wharf on that side and placed in the racks by means of a narrow-gage railway and distributed thence to the different boring, cutting and punching machines by means of the same narrow-gage, which is continued around the building. A powerful traveling crane takes the prepared materials to the yard and then they are delivered by the overhead conveyors to the different ships.

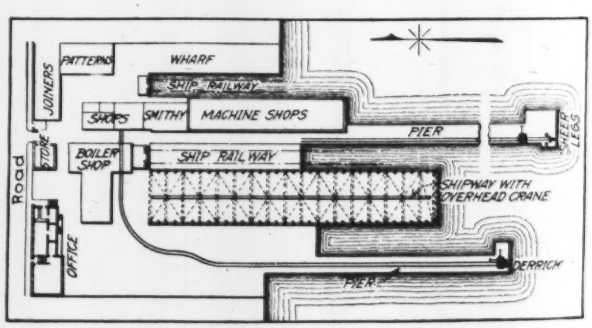


FIG. 4. WALLACE SHIPYARD, NORTH VANCOUVER, B. C., WHERE 8800-TON STEEL SHIPS ARE BUILDING

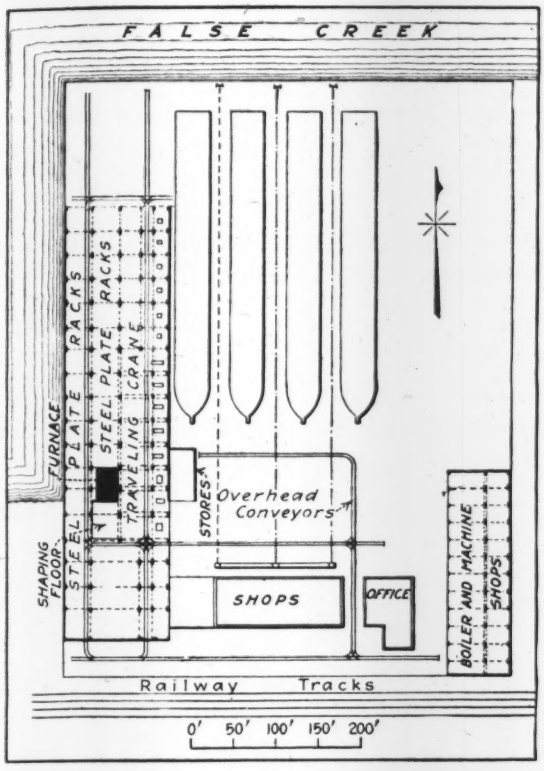


FIG. 5. COUGHLAN SHIPYARDS, WHERE BRITISH COLUMBIA STEEL SHIPS ARE BEING BUILT

An extensive shaping floor and furnaces are included in this wing, where the ribs, bearers, beams and stanchions are bent to the templets. A three-story boiler shop forms the eastern wing, for the engines and boilers are designed and built in the yards.

Deep Drainage of Foundation Soil for Heavy Building

Open-Joint Brick Sewer 35 Ft. Below Ground Drains Foundation Soil—Straw and Cinder Filling Over Sewer

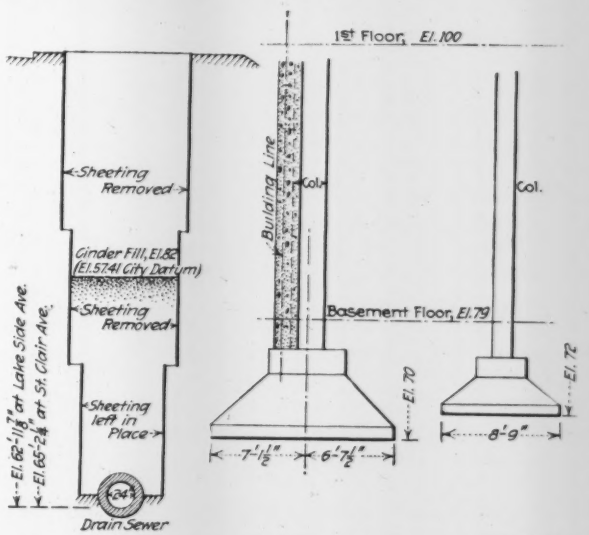
DEEP foundation-soil drainage by an open-joint sewer was employed in connection with the foundation work of the Cleveland municipal auditorium, or public hall, now under construction. The building, 213 x 590 ft., is not only large but has heavy foundation loads on account of its large central auditorium with long-span roof. The site is within a few hundred feet of the edge of the lakeside bluff, being in the square between St. Clair and Lakeside Aves., East 6th St., and East 4th St. The soil in this vicinity is largely sand with some clay, in varying strata, and hard quicksand, changing to blue clay 35 ft. below ground near the south end of the site, and 50 ft. or more near the north end. When wet, the sand is regarded as unreliable with respect to settlement, even at moderate loads. Yet any other foundation than spread footings would have been very costly and of doubtful merit.

Ground water is about 24 ft. below grade. The necessity of providing for a basement story 18 ft. high in the clear brought the lowest footings about 33 ft. below ground, the basement floor itself being just a few feet above ground water level. Some of the column loads approach two million pounds. It was decided that drainage of the subsoil gave the best assurance against settlement of the footings. Since the sand has excellent bearing capacity when dry, the reduced size of footings also made the drainage plan economical.

The underlying clay at its highest point, near the south end of the building, fixed the elevation of the drain as about 35 ft. below ground. The drain slopes down about 27 in. in the 600 ft. from St. Clair Ave. to Lakeside Ave. At its north end it discharges into an 8-ft. interceptor in Lakeside Ave., 45 ft. below ground level.

The drain is a circular brick sewer of 24-in. inside diameter. Its location with respect to some of the main building footings nearby is illustrated by the sketch herewith. The architect assumed that the ground water slope toward the drain might be as steep as 1 on 2, and that the nearest edge of any footing should be kept above this slope line to make sure of having dry ground beneath the footing under all conditions.

The invert of the drain is laid solid in cement mortar. The sides and arch, however, have open end joints of the brickwork, only the sides of the brick being buttered. To facilitate drainage to the sewer and at the same time prevent the entrance of sand, a 1-ft. bed of straw is



FOUNDATION DRAINAGE SEWER AROUND CLEVELAND PUBLIC HALL (SECTION AT EAST SIXTH ST. FRONT)

laid over the top of the arch and the sewer trench is then backfilled with cinders to a depth of about 16 ft., forming a permeable mass that will intercept groundwater flowing toward the site of the building from the surrounding ground and divert it to the sewer below.

With the footings thus carried on dried-out soil, a loading of 3 tons per sq.ft. was used for all the column foundations.

The public hall was designed by Frederic H. Betz, city architect of Cleveland. The plan of subdraining the foundations follows the method used some years ago at the site of the court house and the city hall. Hoag & Dahl are contractors for the drain.

Mixing Baffles Cut Down Chemicals at Jackson, Miss.

Installed at Slight Expense, They Materially Reduced Alum Required in Mechanical Water Filtration Plant

By John R. Baylis
Chemist, Water-Filtration Plant, Baltimore, Md.

THE usefulness of baffles in the coagulation basins of mechanical filtration plants is illustrated by experience at the water-works of Jackson, Miss. A notable saving of alum has been effected, but more particularly when the turbidity is relatively low.

Jackson, Miss., obtains its water supply from Pearl River at a point just above the city. Prior to the construction of a filter plant in 1914 the water was used without treatment. The river has a drainage area of over 3000 sq.mi. above Jackson, mostly woodland country, and is not very thickly populated. The water is not highly polluted but at times has considerable turbidity.

Water is pumped from a low-lift pumping station to a storage reservoir holding about 6,000,000 gal., and to the coagulating basins. Electric current is obtained for 1¼c. per kw. for pumping at off-peak loads, so part of the day water is pumped direct to the coagulating basins and the balance of the time is taken from the storage reservoir. This causes the turbidity to vary considerably during the day, making it more difficult to regulate the amount of chemicals to be used.

There is nothing unusual about the design of the negative-head mechanical-filter plant. It has two coagulating basins with a capacity of 325,000 gal. each, four filters of a capacity of 1,000,000 gal. each, and a 500,000-gal. clear-water reservoir. The period of sedimentation in the coagulating basins is usually from 4 to 6 hours, but may vary considerably from this at times through variation in pumpage to the city.

As constructed the lime was fed into the pipe line carrying the water to the coagulating basins at a point about 100 ft. and the alum about 60 ft. from the basins. This gave the lime a slight mix before the alum was added. From 2 to 4 grains of alum per gallon was added, depending on the turbidity of the raw water; and a small amount of lime to prevent any free alum in the filtered water.

Shortly after starting operation there were complaints of red water and bad taste due to corrosion of the pipes by the carbonic acid, which varied from 10 to 20 parts per million in the filtered water. The filter beds gave considerable trouble in the summer of 1915, becoming air-bound after 4 to 6 hours' use. The cause of this trouble was not determined, but may have been due to the carbonic acid, as there was no further trouble the next year, after it had been reduced. The bacterial results were not very good, but as the raw water was not badly polluted no great effort was made to increase the efficiency

Beginning October, 1915, more lime was added to reduce the carbonic acid, which required more alum to produce coagulation. To give a water free from carbonic acid required from 1½ to 2 grains of lime and from 4 to 6 grains of alum. This was an excessive amount of chemicals, so experiments were made toward obtaining better results. It was found that good coagulation could be obtained without the use of lime and with considerably less alum than was being used. After a slight sedimentation the addition of lime did not affect the coagulation. The lime pipes were changed the latter part of February, 1916, so as to add lime to the water where it passed from the first to the second coagulating basin, being half the period of sedimentation. By this change the carbonic acid was reduced to nearly zero without the use of more alum.

Table I, showing the effect of adding lime to the water before alum, gives an average of numerous laboratory tests.

In making these laboratory tests it was noticed that considerably less alum was required than was actually being used in the plant. This was thought to be due to a more thorough mixing in the laboratory so in July, 1916, mixing baffles were constructed in the first coagulating basin, at a cost of only $57. The results (Table II) show a considerable saving. Possibly some of this was due to better-trained operators, but it is believed that most of it should be credited to the mixing baffles.

TABLE I. EFFECT OF ADDING LIME BEFORE ALUM.

(Raw water: turbidity, 115; alkalinity, 20.0; carbonic acid, 4.4)

Amount of alum necessary to form a floc within 5 minutes after one minute agitation.

Grains per Gallon			
Lime	Alum	Alkalinity	Carbonic Acid
0.0	1.9	7.0	15.8
0.5	2.6	10.0	14.3
1.0	3.0	17.0	13.2
1.5	3.4	20.0	7.9
2.0	3.9	29.0	3.5
3.0	4.5	42.0	0.0

The saving seems to be more when the turbidity is low than when it is high. When the turbidity is above 100 the amount saved is not very great. In tests at the plant to get some idea of the saving in alum it was found that it amounted to nearly 50% when the turbidity was below 15 and only something over 10% when above 100.

It will be seen from Table II that the average amount of alum used after constructing the mixing baffles in July, 1916, was 1.8 grains as compared with 3.1 grains used before their construction. The turbidities were not recorded as regularly as they should have been, so the true turbidity may vary a little from that given.

TABLE II. AVERAGE AMOUNTS OF LIME AND ALUM, 1915-17

Date	Grains per Gallon Alum	Grains per Gallon Lime	Carbonic Acid Filtered Water	Approximate Turbidity
July, 1915	2.6	0.4	....	15
Aug., 1915	2.6	0.1	15.0	12
Sept., 1915	2.5	0.1	16.0	10
Oct., 1915	3.6	2.0	6.0	15
Nov., 1915	2.8	2.6	7.0	12
Dec., 1915	3.6	2.1	16.0	40
Jan., 1916	3.8	2.0	17.0	65
Feb., 1916	2.9	1.4	18.0	25
Mar., 1916	3.1	1.7	1.0	30
Apr., 1916	3.1	1.7	0.5	25
May, 1916	3.6	1.7	0.9	50
June, 1916	3.7	1.9	1.0	55
*July, 1916	2.8	1.8	0.6	35
Aug., 1916	3.0	1.0	1.0	115
Sept., 1916	1.6	1.0	1.3	35
Oct., 1916	1.2	0.9	2.0	15
Nov., 1916	1.0	0.7	2.2	10
Dec., 1916	1.5	0.6	2.6	20
Jan., 1917	2.4	0.3	....	..
Feb., 1917	2.6	0.2	....	..
Mar., 1917	1.9	0.5	....	..
Apr., 1917	2.1	0.3	....	..
May, 1917	1.7	0.3	....	..
June, 1917	1.3	0.3	....	..
July, 1917	1.5	0.1	....	..

* Mixing baffles introduced.

The water-treatment plant was designed in the office of George W. Fuller, New York City. The writer had

charge of construction and for two years was also in charge of operation. He resigned as manager of the Jackson water-works in December, 1916. The results given since that date are from records kept at the plant and are believed to be nearly accurate. From the best information that can be obtained the turbidity for the two years has averaged about the same.

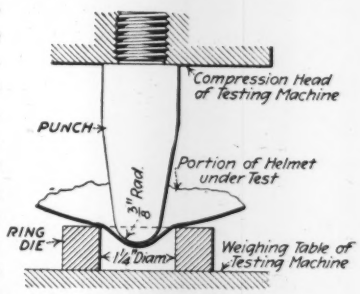
Punching Test To Indicate Strength of Steel Trench Helmets

BY HAROLD A. THOMAS
Associate Professor of Civil Engineering, Rose Polytechnic Institute, Terre Haute, Ind.

TO devise a test capable of measuring the bullet-resisting capacity of trench helmets proved an interesting problem for the testing laboratory at Rose Polytechnic Institute. These helmets have somewhat the shape of inverted washbasins and are made of alloy steel of great strength and toughness, the thickness of the metal being about that of ordinary blotting paper. They are purchased by the military authorities on the basis of their ability to withstand the penetration of an actual bullet fired in the "ballistic test."

While this test is satisfactory for purposes of acceptance, it was found by a manufacturer to be lacking in sensitiveness and quantitative value as a control in determining neat-treatments to develop the highest qualities of the material.

In order to establish a test suitable for such control, experiments were made with the Brinell hardness test, tensile tests on narrow strips cut from the helmets, and punching tests with a round-nosed punch. The latter proved to be more convenient and sensitive than the others, bringing out differences in the helmets quickly and positively. A punch and die of the dimensions shown on the drawing were found to give satisfactory results. The failure of the material in this test is similar to that which occurs under the flattened nose of a bullet, the metal tearing apart under a stress of tension accompanied by more or less bending.



ROUND-NOSED PUNCH GIVES SENSITIVE TEST

For this reason it appears that the conditions of the ballistic test are more closely duplicated in the punching test than in any other simple static test that is available.

The punch used should be designed with sufficient length to permit a helmet to be turned to bring any portion over the die without interference with the compression head of the testing machine. A centering device for the die is desirable. No trouble with buckling of the metal is experienced if the helmets are punched from the inside outward. In tests made by the writer with apparatus of the dimensions shown in the figure, the load required to produce failure occasionally exceeded 6000 pounds.

Recommends Specific Fees for Engineering Services

Edmund T. Perkins, in Address to Illinois Engineers, Proposes Schedule of Charges Based on Percentage of Cost

A SCHEDULE of charges for engineering services, based on a percentage of the cost of the work, is given in a paper by Edmund T. Perkins, Chicago, presented at the recent annual meeting of the Illinois Society of Engineers. The percentage varies with the total cost, its total decreasing as the total cost increases. This is shown by the accompanying table. The percentages are computed upon the entire cost of the completed work, exclusive of engineering; or upon the estimated cost pending execution or completion. The term "cost" refers only to such part of the whole work or project as the engineer may deal with.

Charges for engineering service on a per diem basis may be as follows, the charge being for each day absent from the office. This does not include expenses, which will be added to the per diem charge. Chief engineer, $500 retaining fee and $100 per day; assistant chief engineer, $50 per day; topographical assistant engineer and chief of party, $15 to $25; designer, $12.50; instrument man, draftsman and computer, $7.50; stenographer, chainman and axeman, $3.50. Attendance at court or expert testimony for any fraction of a day is considered as a full day.

Services generally charged for on a percentage basis include reconnaissance, preliminary reports, plans, specifications, details, supervision, progress estimates, superintendence, alterations, professional advice, consultation, court work and arbitration. Surveying should be charged for on the per diem basis.

Charges on other bases than the above were outlined by Mr. Perkins in his paper. A fixed fee for services rendered may be charged by agreement. Where a long engagement for professional services is contemplated, the engineer may accept such retainers on a yearly basis, at a compensation not less than that of the permanently employed engineer of the client. Except in cases where the compensation is in the form of an annual retainer, the agreement between the engineer and his client should specify the period of time during which the compensation as determined by per diem charges, fixed fee, or agreed percentages, shall apply. If, through no fault of the engineer, the work should not be completed within the time so specified, an additional charge may be made, the basis for which, if practicable, should be agreed upon in advance.

TABLE OF ENGINEERING CHARGES ON PERCENTAGE BASIS

	Less than $5,000	$5,000 to $10,000	$10,000 to $20,000	$20,000 to $50,000	$50,000 to $100,000	$100,000 to $200,000	$200,000 to $500,000	Over $500,000
	%	%	%	%	%	%	%	%
Reconnaissance	2.0	1.75	1.5	1.0	0.75	0.5	0.4	0.3
Preliminaries	1.5	1.0	0.8	0.6	0.5	0.4	0.3	0.2
Plans and specifications	4.0	3.5	3.0	2.5	2.0	1.5	1.3	1.2
*Supervision	2.0	1.8	1.5	1.3	1.1	1.0	0.8	0.6
Superintendence	5.0	4.5	4.0	3.5	3.3	3.0	2.8	2.4
†Alterations	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5
Everything from beginning to completion of job	12.5	10.75	9.3	7.9	7.4	6.0	5.3	4.2

* Supervision is not charged for when superintendence is charged.
† Alteration relates only to value of work involved in alteration.

Earth Dam Has Screened Gravel Core and Pipe Drains

Pervious Interior and Drainage System Prevent Saturation—Dam Has Steel Movable Crest, Concrete Spillway and Outlet Culvert with Gate Tower

By L. V. Branch
Engineer, U. S. Reclamation Service, Sherburne, Mont.

SATURATION of an earth dam by seepage from the sides was an unusual condition to be provided against in the design of the Sherburne Lakes irrigation dam in Montana. Instead of making the core-wall water-tight, therefore, it is purposely made permeable to allow the escape of water that may find its way into the upstream section. A system of pipe drains provides for carrying off this water so that it will not saturate the downstream section. The dam is 900 ft. long, with a maximum height of 83 ft. above the bed of the creek, and has a content of nearly 250,000 cu.yd.

In connection with the irrigation of lands in the Milk River Valley of northern Montana, the U. S. Reclamation Service is developing a storage reservoir on Swift Current Creek, in the eastern portion of the Glacier National Park. The reservoir is formed by the construction of the Sherburne Lakes Dam, just below the outlet of the Lower Sherburne Lake. The present development of the reservoir site will have a capacity of 76,000 acre-feet. The stored water will be diverted to the Milk River drainage area through the St. Mary Canal, which was completed by the Reclamation Service in 1915.

On account of the great amount of seepage from adjacent sidehills and the high clay content of available construction materials, the design of the dam provides for an unusually complete drainage system. Instead of the clay-puddle or concrete core-wall used in many earth dams, this dam has the unusual feature of a core-wall of screened gravel with connecting drain pipes. The removal through the core and drains of any moisture penetrating the dam should prevent the saturation of the downstream half of the embankment.

The limited quantity of pervious material available made it impracticable to incur the expense of building the downstream portion of the dam of such material. The whole dam, therefore, is built of the nearly impervious natural mixture of clay, sand and gravel found in the spillway channel cut. This contains a considerable excess of clay.

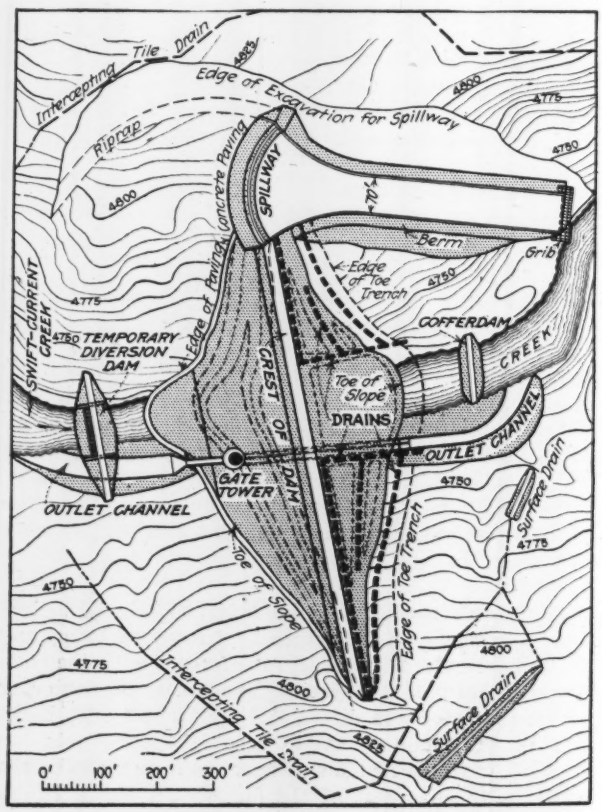
The maximum section of the dam, with the location of the spillway and outlet structures, and the drains and cutoffs under the dam, are shown in the drawings. The upstream slope has an 18-in. paving of field stone on a 12-in. layer of gravel. The stones are the largest available that can be placed by hand, none having a depth less than 15 in. The paving above maximum water level will be grouted, and will be surmounted by a concrete parapet wall projecting 3 ft. above the surface of the grouted paving. The top of the embankment will have a 3-ft. layer of coarse gravel or cobbles. The downstream slope is covered with 12 in. of gravel.

The embankment is divided longitudinally by the core of screened gravel. This extends from end to end of the dam, and from the crest down to a depth of 1.5 ft. into the impervious boulder clay forming the foundation of the dam. In the mid-creek section, however, the gravel core does not extend below the level of the lateral drains. The width of this core is 5 ft. at the crest, widening toward the base by a batter, on each side, of 3.5 in 100. Built into it at 6 in. above the bottom is a longitudinal drain of 8-in. cast-iron pipe laid with open joints.

Under the upstream portion of the embankment two cutoff trenches were excavated to the boulder clay formation. These are 14 to 26 ft. deep, with bottom width of 10 ft. and side slopes of 1:1. They have concrete cutoff walls extending 2½ ft. down into the clay and up 2½ ft. into the dam. These walls are 12 in. thick in the clay and taper to 6 in. at the top.

Stability is given to the downstream toe by a toe-trench 20 to 30 ft. wide, excavated to the boulder clay and filled with coarse gravel and cobbles, as shown. An 8-in. drain is placed in the bottom of the downstream side of this trench.

Midway between the core-wall drain and the toe-trench drain is another 8-in. drain. These three longitudinal drains connect with two transverse 10-in. drains



PLAN OF SHERBURNE LAKES DAM WITH DRAINS AND SPILLWAY

BUILDING THE SHERBURNE LAKES DAM IN MONTANA

The wagon in the center is crossing the gravel core which provides for drainage; the spillway structure is in the background

discharging into the creek below the dam at the low-water level of the creek. All the drains are of cast-iron pipe, laid with open joints in a bed of screened gravel.

A drag-line excavator with 14-ft. turntable was used for a portion of the cutoff and drainage trench and for all of the outlet structure. But at least half of the 78,000 yd. of trench excavation was handled by teams with slip and fresno scrapers. The material for the embankment is excavated by steam shovels from the adjacent spillway cut. It is hauled to the dam in dump wagons and spread in 6-in. layers, all rock having any dimension over 6 in. being removed. It is then rolled with a 20-ton traction engine.

The material as excavated contains approximately the proper amount of moisture for proper compacting. On hot windy days the material as spread on the embankment receives a slight additional wetting from a sprinkling cart. During wet weather it was impossible to properly work the material in the embankment on account of the moisture.

The spillway is at the north end, and consists of an overflow weir with a net length of 160.25 ft., or a gross length of 179.4 ft. This discharges into a concrete-lined channel narrowing to 70-ft. width. The channel is 554.3 ft. long and discharges into the creek at the level of the creek bed. The fixed crest of the weir will be 15 ft. below the top of the dam, but will be surmounted by a movable crest, giving an additional 5 ft. of storage. This spillway will have a capacity of 8000 cu.ft. per sec. with a 9-ft. freeboard on the dam.

The permanent crest of the spillway is a massive block of concrete, founded on a bed of compact boulder clay and provided with protective apron and cutoff walls. It contains the conduits and recesses necessary for the movable crest, which will be of structural steel.

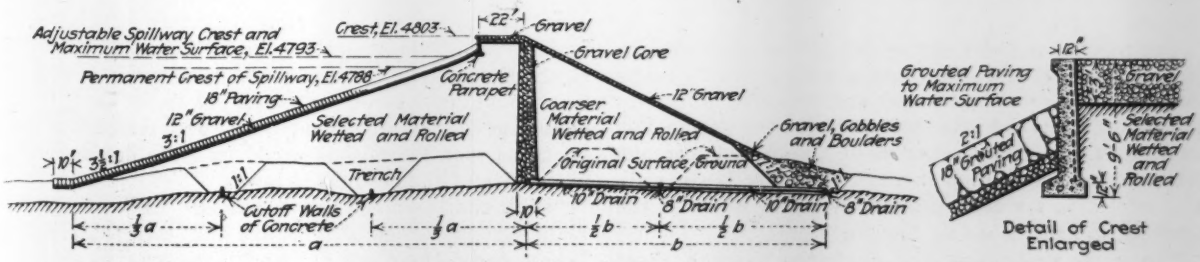
The movable crest will be a sector in cross-section, composed of about one-sixth of a circle of 6-ft. 8-in. radius. It will be constructed in 20-ft. sections, but will operate as four units of double this length, each unit controlling the spillway discharge in a 40-ft. interval between bridge piers. Hinged at the center of radii to the upstream side of the pit, the rotary rising motion of the gate is caused by flotation, or water pressure on the under side, due to admission of water from the reservoir to the pit through small conduits.

The crest gates will be lowered automatically, at proper reservoir stage, by the operation of siphons which remove the water from under the gates. These siphons have a greater capacity than the small openings which admit the water to the pit. Siphon piping for the control of the gates is installed in chambers in both abutments and in the middle bridge pier of the spillway.

[The device is fully described in *Engineering News-Record* of Jan. 17, p. 124.]

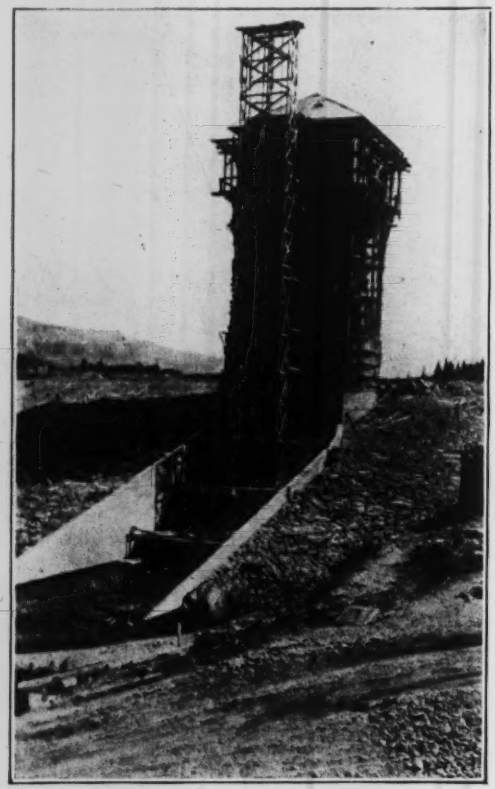
The outlet of the reservoir is a double concrete culvert located in a cut. Each opening is a modified horseshoe section, 6 ft. wide and 8 ft. high, giving a total waterway area of 84.4 sq.ft. Connection to the culvert is through a double-walled circular gate tower.

The tower is 37 ft. outside diameter at the bottom and 107 ft. high to gate-house floor. The lower 60 ft. is buried in the dam for protection from ice thrust. Entrance is by means of a 30-ft. channel 83 ft. below the crest, and formed in the dam by parallel walls. The tops of the walls conform to the face slope of dam.



SECTION OF SHERBURNE LAKES DAM SHOWING DRAINS WHICH PROVIDE FOR SEEPAGE WATER

As the Sherburne Lakes are shallow, providing little natural storage, the floor of the outlet structure was placed at the same level as the former creek bed. Between the inlet retaining walls is placed a grillage of steel rack bars supported by steel I-beams and concrete beams. This grillage has a net waterway area of 1135 sq.ft., which is 9 times the full gate opening and 13½ times the conduit waterway opening.



INLET SIDE OF GATE TOWER
Cross frames in channel will support screen racks. Note the paved slopes

Back of the grillage and connecting with the outer tower is the emergency gate structure. This consists of six slide gates located side by side between the inlet retaining walls. The opening of each gate is 3 ft. wide and 7 ft. high, giving a total waterway of 126 sq.ft. These gates are operated by steel stems connecting with 18-in. hydraulic operating cylinders located at the level of the gate-house floor. Oil pressure will be furnished by a 20-hp. gas engine operating a vertical, single-acting triplex pump. The emergency gates discharge into the space between the two circular walls of the gate tower.

The regulating gates are in duplicate and located in the inner tower wall. One gate has its sill 10 ft. below the invert of the outlet conduit and will always be submerged. The second gate is 55 ft. above the other. For each gate the waterway consists of nine radial openings 3 ft. wide and 4 ft. high through the inner tower wall. The total area for each gate is 126 sq.ft., which is the same as that furnished by the slide gates.

The gates controlling the discharge through these openings into the inner tower are cast-iron cylinders 12 ft. in diameter, each weighing 18,000 lb. Each cylinder is operated by three 3-in. steel stems controlled by hand gear in the gate house above.

Work on the Sherburne Lakes dam was started under the supervision of H. N. Savage, then supervising engineer of the U. S. Reclamation Service. It is now under the direction of F. E. Weymouth, chief of construction for the Service. Arthur P. Davis is director and chief engineer of the U. S. Reclamation Service. The writer is the construction engineer.

Effect of City Zoning on Sewerage System Design and Cost

Impervious Area, Volume of Sewage, Length, Depth and Cost of Sewers, Are All More or Less Affected

HOW the cost of a sewerage system would be affected if a zoning or districting system were adopted before the sewers were designed has been outlined by W. W. Horner, engineer of sewer and paving design, St. Louis, Mo., for the city planning commission of that city. Through the courtesy of Mr. Horner and of H. S. Bartholomew, engineer city planning commission, we are enabled to present Mr. Horner's outline.

"The cost of sewerage depends on: (1) the size of the sewers; (2) the length of sewer per acre; (3) average depth.

"*Size:* Sewer size varies with the amount of rainfall to be carried off, area to be drained inversely with the slope, and finally with the surface characteristics of the area. The first three are natural conditions, predetermined for any district; the last is an artificial condition which, through the class of development, fixes the amount of surface to become impervious, and thus affects radically the amount of rainfall reaching the sewers. It can be shown that for the same rain the amount of water to be carried in the sewers may be twice as much in a business district completely occupied and impervious as in a suburban district of well separated homes.

"Taking the required sewer capacity per acre of the office building district as 100%, the capacity required for a solidly built apartment house district would be 75%; for an average residence district, 65%; and for a residence district with large yards, 55%. Industrial districts may vary from a required capacity of 90% for manufacturing largely under roof, to as little as 40% for manufacturing requiring large yard storage.

"While this factor of proportion of impervious area, vital to the sewer designer, will be generally fixed by occupancy restrictions, it would undoubtedly be of great advantage to have it even more definitely fixed by area limitations. This would not be of importance in the mercantile district, where areas unoccupied by buildings would undoubtedly be paved, but would be of great advantage to the apartment house and residential districts, as such limitations would fix quite definitely the proportion of the grounds in lawns.

"With the combined sewer system (95% of the St. Louis system carried both sewage and storm water), the height restrictions are of importance only in extreme cases. This is for the reason that they will not affect

the amount of rainfall reaching the sewer but will only affect the amount of sewage, which in ordinary residence districts is less than 1% of the amount of rainfall and is neglected. In solid apartment house districts it is a factor but will affect the total very little. In the mercantile districts, however, the difference in the amount of sewage from a five-story building and from a 20-story building would be an appreciable percentage of the total capacity required.

"Length of Sewers: In a mercantile or residential district sewage facilities must be provided for every lot. In an industrial district it is sufficient to provide one or two sewer connections for a block and sometimes for two or more blocks. It has happened more than once after an area has been sewered in such detail as would be required for subdivision into residence lots, and when this has been done with the full consent and approval of the owners, that this district is then developed as industrial property; that some of the streets are either not dedicated, or if already dedicated are vacated; that the location of sewers required for the industries is entirely different from that laid out and generally a much smaller length of sewers is required. This is a direct waste that could have been avoided but remains as a charge against that particular property. Area and height limitations will have little effect on this factor in the cost of the system.

"Depth of Sewers: The cost of excavation for sewers will generally be about one-third of the whole cost of the sewer system, therefore any appreciable saving in excavation will be a real factor in reducing the cost of the system.

"In purely residential districts, even in apartment districts if there are no stores, we find that the basement floors are about 4½ ft. below the yard level and as the yards, as a rule, are somewhat above the street, a system of sewers averaging 4 ft., or at most 5 ft. in depth, will be sufficient for all purposes. The basements of stores, on the other hand, will be from 7 to 8 ft. below the sidewalk and, to allow for their drainage, sewers must be laid from 9 to 10 ft. deep.

"If these two classes of building could be kept in separate districts it would be entirely possible to lay the sewers in the residence district with an average depth of 5 ft. Unfortunately, it has been the custom in St. Louis to build up many of the corner lots in residence sections with stores forming isolated mercantile centers. Because of the possibility of the occurrence of such centers it has in the past been necessary to construct practically all sewers in the residence district for the full depth required for mercantile districts.

"If the zoning will eliminate, or at least fix definitely, the possible locations of the isolated street corner retail centers, the saving in excavation of the sewer systems alone would be enormous.

"In the office building district sewers of great depth are required to drain the deep service basements of the tall buildings. Such basements were naturally not contemplated when our present office building district was sewered and it has therefore been necessary for the owners of the large buildings to construct deep sewers privately, or to install and operate pumps. Eventually the city must resewer this section. Even here the effect of districting on sewer design might be felt if the tall buildings with their consequent deep basements to be confined to as compact an area as possible.

"To summarize this from the standpoint of districting: It has been shown that both occupancy restrictions and area limitations tend to fix a definite percentage of impervious area from which the sewer designer must be prepared to carry off practically the whole rainfall. It has been shown that occupancy restrictions tend to indicate points at which sewerage service must be given and thus prevent waste or loss through the construction of a too great or of an insufficient length of sewer.

"It has been shown further that occupancy restrictions, aided possibly by area limitations, will indicate definitely the depth at which sewers must be laid.

"While it would not be expected that the districting regulations would fix absolutely any of the factors mentioned, they would undoubtedly make it possible for the engineer to choose a basis for his design with a reasonable prospect of seeing it accomplished.

"The sewerage system of St. Louis, as it now stands, has cost over $20,000,000. Many of the sewers are too small and relief sewers must be built; a few of them are too large and a portion of the original investment has been wasted. It does not appear to me at all impossible that 10 or 15% might have been saved on the cost of this system if a definite plan for the development of the areas had been adapted when the system was designed.

Water-Works Should Push Sales

Both Privately and Municipally Owned Plants Urged To Get Consumers by Advertising and Salesmanship

By Charles M. Bell
Woodcliff, N. J.

In the last decade it has been the almost universal custom of public utility commissions to lower water rates until there are few companies that have not been affected. During the last two or three years the increasing cost of labor, materials, fuel, etc., has presented another difficulty until at the present time it is quite a problem for superintendents to keep the balance on the right side of the ledger and the payment of dividends in many cases is out of the question unless some change takes place. There is a recourse to which few companies have as yet resorted. That is to carry on a systematic campaign of advertising and salesmanship. There seems to be no logical reason against such a plan.

In the water business it is the duty of corporations to their stockholders to pay dividends. With municipally owned concerns it is their duty to the taxpayers to distribute the cost as much as possible. It is the duty of both to show the people the advantages derived from using pure water.

Campaign Against Open Wells

Thousands of people live on streets in which a water main has long been laid, but still persist in using shallow open wells. Many of these wells are so polluted as to render their use a menace to the health of the com-

munity, but this fact is unknown to the users. They can "tell by the taste" that the water is good; they need to be shown that it is dangerous.

In many streets where there are several houses close together no mains have been laid, although it could be done with very little expense compared to the revenue which would be received. The owners in many cases would be glad to have water service installed but they lack initiative. They would gladly follow a leader—a water salesman.

There is a field which has scarcely been touched as yet. How many superintendents, to say nothing of consumers, are aware of the fact that a water-power clothes washing machine can be operated much more cheaply than an electrically-driven machine of like capacity and can be purchased for from one-third to one-fourth the cost of the latter? Yet the electric companies are selling thousands of their machines. How many water companies have a sales department to exploit machines designed for the consumption of water? The chances are that the use of such appliances is discouraged rather than encouraged.

Sell Water for Irrigating Truck Gardens

In late years overhead irrigation of truck gardens has come to the front and has proved one of the biggest boosts the farmers have had. This has been discussed more or less in farm papers and to some extent in engineering journals, but there are too many farmers who do not read farm journals and few who see engineering papers. It is this class to whom the water companies should appeal by salesmen. In these war times it is the duty of everyone to increase production in every way possible. The engineering force should be ready to advise and assist the farmer and inquiries should be solicited. This field for advertising is almost limitless near the large cities and any water company that does not take advantage of the opportunity is losing revenue by not doing so. The only serious drawback is the fact that the greatest demand for water will come in the worst stage of a drought, but where storage capacity is ample or the supply great enough this does not enter into the proposition. The cities getting their supply from such a source as the great lakes are good examples of this class.

It should be the policy of every large concern selling water to have its own bacterial laboratory. This does not necessarily mean a large outlay, as it does not take an elaborate plant to make simple analyses. All persons using private wells should not only be invited to make use of the laboratory but should be urged to do so—if necessary by a personal call of some representative of the water company. These tests should be made at the expense of the company which would in the end profit by them.

A sales department should prove a valuable addition to most water-works. A policy of systematic advertising should be instituted the same as any mercantile establishment and it should have for its object the enlisting of every inhabitant within the territory supplied as a consumer of pure water. Such a policy would not only increase the earnings of the water company but would also improve the health of the community which it serves.

American Engineer Officer Tells of Instruction at British Front

AN INDICATION of how American engineer officers now in France are preparing for their work with the fighting forces is given in a letter just received from a well known hydraulic and water-works engineer who has been assigned to the Chief Engineer, American Expeditionary Force, and who for the last three months has been connected with the water-supply and sewerage work of the American combatant troops. This engineer spent some months last fall in an officers' training camp and sailed for France early in the winter. Some interesting paragraphs of his letter are reproduced here:

"After nine days at headquarters I joined the British army for four weeks of intensive observation and study. A week ago I returned and am busy aiding in organization matters. Needless to say, the experience at the British front was a wonderful one, intensely interesting and absorbing. The British officers made me one of themselves, so to speak, and I had access to practically every phase of military activity. Brig. Gen. ————, Royal Engineers, invited me to dinner and a day more at a certain corps headquarters would have meant dinner with Lieut. Gen. ————, who is the corps commander.

"Then there were the water-supply service, the trenches, the tanks, aëroplanes, anti-aircraft guns, bombing raids, razed villages by the score, German reinforced-concrete strong points (captured by the British), marvelous motor transport, hospitals, artillery, barelegged Highlanders, shivering Hindus—and so I could keep on. A wonderful machine is the British army and it is fortunate for us that the British so cordially invite the American army to benefit by British experience.

Interesting and Absorbing Experience

"The desolation in the territory evacuated by the Boche in his retreat to the Hindenburg line is awful to contemplate. But, of course, even that great waste is but little compared with the loss of human life. Altogether it has been a mighty inspiring as well as absorbing experience for me.

"I want to confess that the first time I was under shell fire I felt like turning back, but gradually I became used to the great game of chance—that is, the chance of being hit. As it was, a British officer and I left a certain spot only ten minutes before a high explosive shell wiped out the neighborhood. However, I can't say that I'll ever become hardened to bombing raids. One feels so helpless, especially when one can hear the Boche aëroplane but cannot see it."

In conclusion the letter gives the names of a number of very well known American engineers whom the writer has come across at the front and tells of some of the interesting work they are doing. The exigencies of the censorship for the present forbid the printing of such information. The letter does say that the officer received his first letter from home two months after he had left America, which may account for the dearth of information that is coming from the engineer troops at the front.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Masterly Report on the Austin Dam

REPORT ON THE DAM AND WATER-POWER DEVELOPMENT AT AUSTIN, TEX.—By Daniel W. Mead, November, 1917. Madison, Wis.: Daniel W. Mead and Charles V. Seastone, Consulting Engineers. Paper; 8½ x 11 in.; pp. 205; 107 line and halftone illustrations.

For this masterly report on the ill-fated Austin dam the author deserves the thanks not only of the City of Austin but also of other American cities, the engineering profession at large, contractors engaged in public works, dealers in private corporation securities and holders of the bonds of franchise companies. Although the primary object of the report was to determine what should be done to make the dam safe and how the cost should be divided between the franchise-contractor and the city, a clear understanding of the whole subject and justice to all concerned led Mr. Mead to do far more. He presents in his report a history of the whole dam and power project, covering a period of a quarter of a century. It is not easy to say whether the report is most valuable as an engineering document or as an exhibit of deplorably bad municipal and private administration. In reality, the first value includes the second.

The first thirty pages of the volume contain the report proper. There follow appendixes taking up in detail the history of the original Austin dam, including its failure in 1900, and various reports thereon; the franchise contract for the reconstruction of the dam and power house and their operation; the construction work under the contract just mentioned, as well as changes in plans; results of Mr. Mead's searching examination of the dam, power house and accessories in August, 1917; criticisms of "Condition and Structures of the Present Installation"; studies of Colorado River stream flow and power possibilities at the dam; crest gates betterments required for the safety of the dam; cost of work done under the franchise contract; recommendations of Dr. A. C. Scott, Mar. 31, 1915; and a bibliography. The fact that the bibliography contains about forty references to *Engineering News* and *Engineering Record* testifies to the part this ill-fated structure has played in the history of engineering since the beginning of 1900.

This report will become a classic in engineering literature. It might well be included as required reading in the curricula of the engineering schools of the country. The portions of the report which deal with the long series of administrative blunders on the part of the City of Austin, including the slipshod and short-sighted franchise contract, are commended to the rapidly increasing number of instructors in municipal government throughout the country as source material, and to the more advanced of their students as well. The analysis of this franchise-contract and of the construction and financing arrangements that followed it deserves careful consideration by bond houses and by contractors.

Management Indispensable to Labor

THE WORKS MANAGER TODAY: An Address Prepared for a Series of Private Gatherings of Works Managers—By Sidney Webb, Professor of Public Administration in the University of London. New York: Longmans, Green and Co. Cloth, 5 x 8 in.; pp. 157; $1.

Surely no labor radical could demand more than the recognition of the fact "that the efficiency of a works manager cannot properly be gaged by his employer's profit and loss account," yet Sidney Webb makes this statement during the course of the development of his thesis, going on further to submit that it is well recognized in England that when a falling off of individual efficiency can be traced to antiquated machinery or poor working conditions it becomes the duty of the management to raise rather than to lower the piece rate. This is modern doctrine with a vengeance, and so far ahead of the usually accepted method of thought that its explanation and justification require a rather full reading of this address delivered by request before a private gathering of works managers.

Other conclusions as remarkable as this can be found on almost every page. For instance, he denies the right of management to cut wages of the manual workers while still continuing directors' fees, dividends and similar payments. He postulates that the really able manager will never allow the workman to make a bad bargain inadvertently, and places emphasis on the imperative necessity for industrial efficiency of a full and cordial recognition of trade unionism as soon as it appears among the employees. Had such statements come from anyone less fully recognized as a thorough student of conditions, in all probability they would have been put down as hysterical and exaggerated for a purpose. But the nature of the gathering, the occasion of the address and the position of the orator give them a grim significance, especially in view of the worldwide alteration of attitude toward this wholly twentieth century problem.

But however strongly the author comes out for the fair treatment of labor, it may always be seen that the animus has its origin in the desire for greater productivity. The complete utilization of the reservoir of human energy is his purpose, and, he assumes, the occasion for management. He sees in the organizer and director of industry the cornerstone of the social structure, and ends as he began, "by emphasizing the fact that, under any social order, from now to Utopia, management is indispensable and all enduring."

Landscape, and Outdoor Theater Design

THE NATURAL STYLE IN LANDSCAPE GARDENING—Frank A. Waugh. Boston: Richard G. Badger. Toronto: The Copp Clark Co., Ltd. Cloth; 6 x 9 in.; pp. 145; illustrated.

OUTDOOR THEATERS: The Design, Construction and Use of Open-Air Auditoriums—Frank A. Waugh. Boston: Richard G. Badger. Toronto: The Copp Clark Co., Ltd. Cloth; 6 x 9 in.; pp. 145; illustrated.

The freshness and outdoor spirit in which Professor Waugh treats the naturalistic style of landscape designing carries the reader quickly through the all too few

pages of this charming essay. The book, as well as the style of landscape design which it so sympathetically explains, should appeal forcefully to the engineer, who above all men is thrown close to nature and who might well leave the formal style of landscape design to the architect.

After a brief introduction the author fittingly considers the native landscape, its form and its spirit, and the landscape motive. Next come the principles of structural composition, the art of grouping, and features and furnishing. A closing chapter deals with the "open field."

The main thesis is that the forms of nature must be studied and her spirit discerned and interpreted if the natural style of landscape design is to be successfully attained. Among other examples the author shows how some kinds of trees and plants keep company under certain conditions of soil or climate and quite different kinds under other conditions.

The text is forcibly illustrated by gems of landscape, mostly from nature herself, handsomely shown by halftone views.

A subject incidentally touched on in the volume just noticed is treated in a companion volume on "Outdoor Theaters." The principles which should govern the design of these are briefly explained and a considerable number of examples are exhibited by means of text, very sketchy plans and sections and halftone views. Some of the larger and more formal and architectural outdoor theaters, like the one of the University of California, are described, and one or two municipal theaters are included.

Planning for Rural Canada

RURAL PLANNING AND DEVELOPMENT:—A Study of Rural Conditions and Problems in Canada—By Thomas Adams, Town Planning Adviser, Commission of Conservation; Past President of the Town Planning Institute of Great Britain; formerly Town Planning Inspector to the Local Government Board of England and Wales, and Secretary and Manager of Letchworth Garden City, Ottawa, Ont.: Commission of Conservation of Canada. Cloth; 7 x 10 in.; pp. 281; 47 figures in the test, and 20 halftone plates and 3 folding maps.

While it is true that "God made the country and man made the town" it is equally true that man has done much to spoil or to thwart the proper development of the rural districts of the United States and Canada by putting both in the rigid bonds of the rectangular system of subdividing land. The evils of this system, as applied in Canada, are convincingly told in one of the chapters of this book, entitled "Present Systems of Surveying and Planning Land in Rural Areas." Its technical details are given in an appendix, by H. L. Seymour, a dominion land surveyor. The subject comes up again and again throughout the remainder of the volume. Numerous maps showing the common and the better way of laying out rural districts drive the argument home.

The author is too well informed and too sensible to condemn the rectangular system out of hand. He well says that it serves admirably as a quick and accurate method of laying out vast tracts of government land, but he urges that it is a poor plan for the highest utilization of rural areas and the furthering of the comfort, convenience and economic progress of the inhabitants.

The rectangular or any other primary system of dividing government land should be followed by more or less detailed topographic surveys as a basis for farm lot subdivisions and the laying out of highways, while with or following the secondary surveys there should be a selection of land in accordance with its fitness for various uses.

Other subjects treated are rural population and production in Canada, railways and highways, organization of rural life and industry, government policies and land development, returned soldiers and land settlement and provincial planning and development legislation.

It is expected that the present volume will be followed by one on urban planning and that a third will be devoted to more detailed "solutions of both rural and urban problems," including "legislative and administrative reforms needed in connection with the planning and development of land."

That Mr. Adams has been given the opportunity to produce so valuable a pioneer work as the present volume and is in a position to promise two more is a credit to the Canadian Conservation Commission. It should also serve as a stimulus for other countries—first of all the United States—to enter upon similar broad minded economic humanitarian studies, especially in view of the coming war reconstruction period.

Surveying Instruments and Their Use

Reviewed by H. S. SPENGLER
Assistant Professor of Surveying and Railroad Engineering, Lafayette College, Easton, Penn.

TECHNIC OF SURVEYING INSTRUMENTS AND METHODS: Including General and Detailed Instruction for Field and Office Work of Extended Students' Surveys—By Walter Loring Webb, C. E., M. Am. Soc. C. E., and John Charles Lounsbury Fish, C. E., M. Am. Soc. C. E. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Leather; 4 x 7 in.; pp. 319; illustrated. $2.

A rewritten combination of the greater part of Webb's "Engineering Instruments" and Fish's "Technic of Surveying Instruments," this book is intended to be used by engineering students as a supplement to a general textbook on surveying. It consists of six parts.

Part I is devoted to general directions (with a praiseworthy lack of unnecessary detail) and includes a table of references, giving for each exercise of the book the numbers of the pertinent articles of four well-known texts on surveying, namely, Breed and Hosmer, Johnson and Smith, Raymond, and Tracy.

Part II consists of a number of field exercises which should give the student a working familiarity with the parts, motions and readings of surveying instruments, and also an idea of the degree of accuracy which is necessary, desirable or possible in instrumental measurements. The attention of the student is constantly called to the care and effort which is required to attain such accuracy.

Part III is composed of various exercises designed to familiarize the student with the methods commonly used in surveying, and to give him further practice in the manipulation of the instruments.

Part IV contains detailed directions for the conduct of a railroad survey, and outlines the various phases of the field and office work; general directions for making topographic and hydrographic surveys; instructions for the advanced student who may be required to plan as well as perform a survey for a specified purpose.

Part V comprises a variety of office exercises, includ-

ing the use of office instruments; construction of the slide rule; vernier earthwork tables and diagrams; graphical solution of topographic and mine survey problems, and methods for expediting computations.

Part VI is devoted to exercises in the use of precision instruments and some probable error formulas.

The authors have well achieved their aim to make detailed directions so complete that the student can go through the routine of exercises without verbal instructions, so that the instructor may be free to watch the performance of each student and give advice, explanation, suggestion, caution, or illustration at such time and in such quantity as best to serve the needs of the student.

Reservoir of Railway Information

RAILROAD STRUCTURES AND ESTIMATES—By J. W. Orrock, M. Can. Soc. C. E., Prin. Asst. Engineer C. P. R. Second Edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Leather; 6 x 9 in.; pp. 579; illustrated. $5.

As a reservoir of information on a wide range of subjects related to railway work, including costs and prices for a variety of materials and structures, this work may be regarded as highly successful and useful. The present edition has more than double the contents of the first one (1909) and three times as many illustrations. Its wide scope ranges from grade separation, tunnels, bridges and stations to culverts, tool houses, track signs and spikes. The prices quoted are those ruling before 1915.

As a work on the making of estimates the book is a disappointment. Estimating is one of the important phases of the engineer's work, but it is one in which error and confusion too often occur, due either to lack of knowledge or to failure to appreciate conditions and their importance. There is nothing in the way of instruction or advice as to the preparation of estimates or the taking of quantities; nothing to show the beginner or the inexperienced man how to proceed. Nor is there even mention of the system of "quantity surveying" so long used abroad and so little known in this country.

Lack of proportion may be expected when such a numerous and varied list of topics is included. For some subjects cost is given in great detail; some have only lump sums stated; still others are presented without prices or quantities. Wood ties are treated at some length as to price, cost and economy. Steel ties are described, but not even a price per ton is given although the type mentioned is in commercial use.

Statements that are not clear or correct occur somewhat frequently. It is said, for instance, that it is normal to place outer and inner guards over the floors of "all deck and trestle bridges." This gives the erroneous impression that they are not used on through or truss bridges. In regard to the distinction between rigid and automatic switch-stands, it is not shown that this applies only to trailing movements on one track when the switch is set for the other track. Possible use of electricity in the precipitation of smoke at roundhouses is mentioned, but not the actual use of water for the same purpose.

Style and wording might be much better, as is so frequently (but unnecessarily) true of books on engineering. In this case the fault is due in part to compilation and condensation, but careless wording and poor English are too often in evidence. These are minor defects. The main defect is the failure to treat the subject of estimating. The book contains so much material, however, that it must needs prove highly useful to the engineer as a source of information. It will also be a help to him in making estimates, provided that he knows how to use, with discrimination, such cost data as are given.

The Great Miami Flood of 1913

THE MIAMI VALLEY AND THE 1913 FLOOD—By Arthur E. Morgan, Chief Engineer. Dayton, Ohio: The Miami Conservancy District. Miami Pamphlet, No. 1. Paper; 6 x 9 in.; pp. 125; illustrated. $0.50 or $2 for series of five pamphlets.

No more stirring account of the 1913 flood in the Great Miami River has appeared than the one here set down by A. E. Morgan. Popular interest was clearly not the author's objective, however. As the first of a series of reports on technical studies which are intended to make the data and deductions of the Miami flood-protection project common property, this pamphlet accomplishes the necessary function of establishing a cause for action. It gives convincing evidence that persistence of the Miami flood danger is incompatible with the existence of civilized communities.

Engineering Studies From Holland

HET WATERGEVEND VERMOGEN VAN EEN GROEP PUTTEN:—Bulletin No. 1 of the Water-Supply Bureau of Holland, November, 1916. By Dr. J. Versluys, Engineer. Paper; 6 x 9 in.; pp. 19. The Hague: Gebrs. Belinfante. 0.50 franc.

DUINVORMING AAN HET MARSDIEP:—Bulletin No. 2 of the Water-Supply Bureau of Holland, September, 1917. By Dr. J. Versluys, Hydrologist of the Bureau. The Hague: Gebrs. Belinfante. Paper; 6 x 9 in.; pp. 11; faps and profiles appended. 0.50 franc

The first bulletin is a mathematical study of well flow, to determine how test pumping from one well can be used to compute the yield of a group of wells. The second is a study of land accretion along the south shore of the Island of Texel, by shoaling of the Marsdiep, sandbank formation and ultimate reclamation by dune growth. Accurate maps of various periods, the oldest of date 1749, supply a record of this accretion. Soundings given on the old maps when compared with modern boring records give a guide to identifying the age of various strata. Alternating sand and clay deposits have thus been shown to form without oscillations of land elevation.

Health and Sanitation in Russia

Two members of the American Red Cross Mission which spent some weeks in Russia during the autumn of 1916 have written interesting papers based on what they learned at that time. Prof. George C. Whipple, Harvard University, addressed the Boston Society of Civil Engineers on Nov. 21, 1917. His notes were printed in the Journal of the Society for December, 1917, and have been reprinted for private circulation under the title, "Russia—an Opportunity for American Engineers." Prof. C-E. A. Winslow, Yale University, contributed a paper to Public Health Reports (Washington, D. C.), for Dec. 27, 1917, on "Public Health Administration in Russia in 1917," reviewing the subject in considerable detail and including a "Plan for the Organization of a Central Sanitary Medical Service." The

portion of Professor Whipple's address which dealt specifically with opportunities for American engineers in Russia was brief and might perhaps be modified, or its applicability at least postponed, if the author were to revise it in view of what has occurred in Russia since November. The major part of Professor Whipple's address was a sympathetic review of Russian conditions leading up to and following in the first few months after the revolution.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other person indicated in the notice.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1916: With Subject Index—By John M. Nickles, Washington, D. C.: United States Geological Survey. Paper; 6 x 9 in.; pp. 172.

COURS DE MECANIQUE—By L. Guillot. Vol. 4, "Moteurs à Gaz et à Pétrole." Paris: Ch. Beranger. Cloth; 6 x 9 in.; pp. 381; illustrated. 23 francs.

A review of gas producers is followed by description of a number of gas engines of different types with their carburetors, valve gears, governors and other details. The Humphrey gas pump of the explosion type is mentioned briefly. The Diesel motor is accorded a separate chapter, and other chapters deal with means of regulating the speed and securing uniformity of speed. About 75 pages are devoted to motors for automobiles and aviation.

DAM SITES ON THE MISSOURI RIVER IN SOUTH DAKOTA—By Charles McCaffree, Commissioner of Immigration. Pierre, South Dakota: The Commission. Paper; 6 x 9 in.; pp. 32; illustrated.

Includes description of sites at Big Bend, 18,000 hp.; Little Bend, 52,000 hp.; Mulehead, 43,000 hp.; Chamberlain, 21,000 hp.; Reynolds Creek, 36,000 hp.; Medicine Butte, 31,000 hp.; Bad Hair, 41,000 hp.; brief resumé of examinations made by Westinghouse Church Kerr & Co., in 1911 and W. H. Finley, chief engineer, Chicago & Northwestern Ry. in 1917.

DESCRIPTION OF THE DUTIES AND CLASSIFICATION OF POSITIONS IN THE CLASSIFIED SERVICE OF THE CITY OF ST. LOUIS—St. Louis, Mo.: Efficiency Board of St. Louis. Paper; 6 x 9 in.; pp. 216.

After working up its classification scheme the board decided to print it with salaries in blank and send out the report as a questionnaire to determine what private employers in St. Louis were paying for services similar to those performed by the 7000 employees of the city.

DISPOSAL OF CITY GARBAGE BY FEEDING TO HOGS—By F. G. Ashbrook and J. D. Debout, Washington, D. C.: U. S. Department of Agriculture. Paper; 6 x 9 in.; pp. 8; illustrated.

A brief popular review of the subject which might well be brought to the attention of city officials and contractors dealing with municipal garbage.

EFFECT OF CALCAREOUS MATERIAL IN SOILS AND ROCKS ON THE AMOUNT OF NITRATES IN GROUND AND SURFACE WATERS—By. M. F. Sanborn, C. E., Assistant Engineer, Division of Sanitary Engineering. Reprinted from the Report of the New York State Department of Health for 1915. Albany, N. Y.: The Department. Paper; 6 x 9 in.; pp. 27; illustrated.

ELECTRIC PUMPING WITH RESULTS OF TESTS AND OPERATING RECORDS—By H. W. Wagner, Mechanical and Electrical Engineer. Bulletin 46, Engineering Experiment Station. Ames, Iowa: State College of Agriculture and Mechanic Arts. Paper; 6 x 9 in.; pp. 79; illustrated.

THE ELEMENTS OF RAILROAD ENGINEERING—By William G. Raymond, C. E., LL. D., M. Am. Soc. C. E., Professor of Civil Engineering and Dean of the College of Applied Science, State University of Iowa. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 447; illustrated. $4.

GYPSUM PRODUCTS, THEIR PREPARATION AND USES—By R. W. Stone, Geologist, U. S. Geological Survey. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 67; illustrated.

HOW TO ORGANIZE DRAINAGE DISTRICTS—By Leroy K. Sherman, M. Am. Soc. C. E., Former Member Illinois Rivers and Lakes Commission. Chicago, Ill.: The Author, 1102 Tacoma Building. Paper; 5 x 7 in.; pp. 18.

Relates specifically to operations under Illinois drainage laws.

KANSAS ENGINEERING SOCIETY: Report of 1917 Meeting. Lawrence, Kansas: The Society. Paper; 6 x 9 in.; pp. 74; illustrated.

MINING DEVELOPMENTS AND WATER-POWER INVESTIGATIONS IN SOUTHEASTERN ALASKA—Papers by Theodore Chapin, H. M. Fakin and G. H. Canfield. Washington, D. C.: United States Geological Survey. Paper; 6 x 9 in.; pp. 154; illustrated.

THE NEGLECTED WATERS OF THE PACIFIC COAST: Washington, Oregon, and California—By E. Lester Jones, Superintendent. Special Publication No. 48. Washington, D. C.: U. S. Coast and Geodetic Survey. Paper; 8 x 10 in.; pp. 21; illustrated.

A plea for better surveys of Pacific coast waters for the greater protection of all shipping in those parts, including our Navy.

PRINCIPLES OF OCEAN TRANSPORTATION—By Emory R. Johnson, Ph. D., Sc. D., Professor, and Grover G. Huebner, Ph. D., Assistant Professor of Transportation and Commerce in the University of Pennsylvania. New York: D. Appleton and Co. Cloth; 6 x 9 in.; pp. 513; illustrated. $2.50.

PUBLIC SERVICE COMMISSION, SECOND DISTRICT: Report for 1916: Abstracts of Reports of Corporations. New York: The Commission. Cloth; 9 x 12 in.; pp. 290; illustrated.

RAPID SAND FILTRATION—By George A. Johnson, Consulting Hydraulic Engineer and Sanitary Expert. Reprinted from Journal of the New England Water Works Association, Vol. XXXI, No. 3. New York City: The Author, 150 Nassau St. Paper; 6 x 9 in.; pp. 83; illustrated.

RECLAIMING THE ARID WEST: The Story of the United States Reclamation Service—By George Wharton James. New York: Dodd, Mead & Co. Cloth; 6 x 9 in.; pp. 411; illustrated. $3.50.

RECREATION IN ST. LOUIS: The City Plan Commission, Harland Bartholomew, Engineer. St. Louis, Mo.: The Commission. Paper; 6 x 9 in.; pp. 48; illustrated.

A comprehensive study of park, playground and other recreation facility needs, considered by wards.

REPORT OF THE COMMISSION FOR THE SURVEY OF MUNICIPAL FINANCING—Trenton, N. J.: The Commission. Paper; 7 x 10 in.; pp. 15.

REPORT ON IRRIGATION SURVEYS AND INSPECTIONS: 1916-17—Ottawa, Canada: Department of the Interior. Paper; 6 x 9 in.; pp. 79; illustrated.

SAND AND GRAVEL IN 1916—By R. W. Stone. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 13.

SURFACE WATER SUPPLY OF THE UNITED STATES—Nathan C. Grover, Chief Hydraulic Engineer. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; illustrated. No. 389: 1914. Part IX. Colorado River Basin. Robert Follansbee, E. A. Porter, C. C. Jacob, and G. A. Gray, District Engineers. Prepared in coöperation with the States of Arizona, Nevada, New Mexico, and Utah. Pp. 198. No. 390: 1914. Part X. The Great Basin. E. A. Porter, H. D. McGlashan, F. F. Henshaw and G. C. Baldwin, District Engineers. Prepared in coöperation with the States of Utah, Nevada, California, Oregon, and Idaho. Pp. 306. No. 403: 1915. Part III. Ohio River Basin. Albert H. Horton and Warren E. Hall, District Engineers. Prepared in coöperation with the States of Illinois, Kentucky, and West Virginia. Pp. 171. No. 408: 1915. Part VIII. Western Gulf of Mexico Basins. Glenn A. Gray, Warren E. Hall, and Robert Follansbee, District Engineers. Prepared in coöperation with the States of Texas and New Mexico. Pp. 108. No. 438: 1916. Part VIII. Western Gulf of Mexico Basins. Glenn A. Gray and Robert Follansbee, District Engineers. Prepared in coöperation with the State of Texas. Pp. 106. No. 404: 1915. Part IV. St. Lawrence River Basin. W. G. Hoyt, A. H. Horton, C. C. Covert, and C. H. Pierce, District Engineers. Prepared in coöperation with the States of Minnesota, Wisconsin, New York, and Vermont. Washington, D. C. Pp. 153.

TECHNOLOGIC PAPERS OF THE BUREAU OF STANDARDS. No. 103: Typical Cases of the Deterioration of Muntz Metal (60:40 Brass) by Selective Corrosion—By Henry S. Rawdon, Associate Physicist, Bureau of Standards. Washington, D. C.: Superintendent of Documents. Paper; 7 x 10 in.; pp. 28; illustrated. 10 cents.

THEORY AND OPERATION OF DIRECT-CURRENT MACHINERY—Prepared in the Extension Division of the University of Wisconsin by Cyril M. Jansky, B. S., B. A., Associate Professor of Electrical Engineering. New York: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 285; illustrated. $2.50.

An elementary work, designed particularly for students with limited mathematical knowledge.

UNITED STATES MAGNETIC TABLE AND MAGNETIC CHARTS FOR 1915—By Daniel L. Hazard, Chief, Division of Terrestrial Magnetism. Washington, D. C.: Superintendent of Documents. Cloth; 6 x 9 in.; pp. 256; folding maps.

URBAN AND RURAL DEVELOPMENT IN CANADA: Report of Conference Held at Winnipeg, May 28-30, 1917—Ottawa, Canada: Commission of Conservation. Paper; 7 x 10 in.; pp. 98.

WAGES AND HOURS OF LABOR IN THE IRON AND STEEL INDUSTRY: 1907 to 1915, With a Glossary of Occupations—Washington, D. C.: Bureau of Labor Statistics. Paper; 6 x 9 in.; pp. 526.

THE WATER-WORKS SYSTEM OF THE CITY OF CHICAGO: Report prepared by the Chicago Bureau of Public Efficiency. Chicago, Ill.: The Bureau, 315 Plymouth Court. Paper; 6 x 9 in.; pp. 207; illustrated.

A general review of the water-works problems of Chicago. The portion of the report dealing with water waste and the desirability of metering the supply, which is a feature of the report, was abstracted at length in Engineering News-Record of Feb. 7, 1918, p. 268.

WHAT IS FAIR: A Study of Some Problems of Public Utility Regulation—By William G. Raymond, C. E., LL. D., M. Am. Soc. C. E., Professor of Civil Engineering and Dean of the College of Applied Science in the State University of Iowa. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 4 x 7 in.; pp. 172. $1.

THE WORKMEN'S COMPENSATION LAW JOURNAL: Reports of all Decisions Rendered in Compensation Cases in the Federal Courts and in the State Appelate Courts—Vol. 1 (January 1918): New York: C. C. Hine's Sons Co., 100 William St. Paper; 7 x 10 in.; pp. 144; $10 per year.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

The American Society's New Constitution

Following are three letters received by Engineering News-Record on the subject of the proposed revised constitution of the American Society of Civil Enigneers. Mr. Hunt's and Mr. Noble's letters are obviously replies to that of Hunter McDonald and Clemens Herschel in last week's issue, p. 325. The other is an expansion of some of the ideas expressed in last week's letter. None were written with any knowledge of the others.—Editor.

Sir—I have before me your issue of Feb. 14, p. 325, in which there appears a letter signed Hunter McDonald, Clemens Herschel.

I do not propose to enter into an argument as to the merits or demerits of the proposed revised constitution of the American Society of Civil Engineers. In this letter, however, there are certain statements made which do not refer to the more or less academic question as to whether the secretary should or should not be a member of the board of direction, but directly to the undersigned. These are contained in two paragraphs of the letter, which, carefully analyzed, make the following statement of facts:

1. That the undersigned believes that the secretary should be a member of the board of direction.

2. That he has stated that he would vote against the revision of the constitution if it contained a provision changing the status of the secretary, and that he had announced his intention to do all he could to defeat the revision in that case.

3. That he has done this in some improper manner, the direct inference being that he has had something to do with circularizing the membership.

4. That the undersigned, in his official capacity, has failed in his duty to the society in carrying out the instructions of the board of direction.

It is true that I am opposed to changing the status of the secretary of the American Society of Civil Engineers. It is true that I have already voted against the proposed revision of the constitution, and it is also true that a number of members have asked my opinion in regard to this matter, and that it has been freely given. It is also true that I have always been outspoken in giving my opinion in regard to the provision in question which I regard as very important to the welfare of the society, but it is also true that each time I have emphasized that I spoke as a corporate member, and not as secretary.

The statements or inferences briefed in (3) and (4) are absolutely false.

I do not think that the public press is the place for discussing, by innuendo or otherwise, the official action of the secretary of the American Society of Civil Engineers, but such statements as are made in this letter require an answer because they are contrary to the code of ethics adopted by that society as well as to one of the Ten Commandments. CHAS. WARREN HUNT.

New York City.

Sir: The letter by Hunter McDonald and Clemens Herschel, in the last issue of *Engineering News-Record*, in regard to the proposed revision of the constitution of the American Society of Civil Engineers, conveys the inference that Secretary Hunt has improperly endeavored to defeat the proposed revision. It is regrettable that statements heretofore expunged by order of the board of direction should have been revived.

As a member of the board familiar with its business, and of the publication committee charged with presenting the revision in amendment form before the membership, I can say from personal knowledge that, although Secretary Hunt, as a member of the committee on revision of the constitution and as a member of the board, opposed the incorporation of features he believed to be injurious to the society's interests, his official opposition ceased upon the adoption of these features by the board. Thereafter, as is clearly shown by the full minutes of the board, officially approved and adopted by it, the meaning of which is not changed by any amount of "reading between the lines," the secretary strictly followed the instructions of the board as to publication.

As one of the members active in preparing the circular to which Messrs. McDonald and Herschel object, both as to its contents and as to the "personnel" of its signers, and in bringing it to the attention of other members known to have the welfare of the society at heart, I can also say that Secretary Hunt neither inspired nor had a hand in preparing that circular.

Not a single voice was raised at the annual meeting in favor of the proposed revision, and the vote in support of the resolutions of disapproval was almost unanimous. Under these conditions it might seem fair to assume that the objections cited must have been sound or else that the meeting lacked intelligence.

The society may "look for something better" in the way of a constitution when the object of making it a vehicle of personal attack is forgotten. Meanwhile, the present constitution will serve as admirably as it has for many years past. FREDERICK C. NOBLE.

Sir—The members of the committee on revision of the constitution of the American Society of Civil Engineers who voted for the proposed form, and those who agreed with them, dutifully refrained from publicly discussing the matter until it should constitutionally come before the society at its annual meeting. Not so the signers and disseminators of the circular letter of Dec. 31, 1917, which few received before Jan. 8—a week before the annual meeting.

Because of war work and similar calls upon their time, none of the members in charge of the subject were present at the meeting, and no discussion was then had. Nor has there been opportunity since then for the opposition to the stampede, and to the workings of society politics represented by the resultant stampede, to confer and act.

The undersigned thus find themselves unable to solicit

signatures in support of the position taken by Past Presidents Hunter McDonald and Clemens Herschel in your issue of Feb. 14. There is little time left in which by any practical method to reach the membership in time for it to consider the subject before voting, and the undersigned have resolved to make such representations in the present communication.

Let no one deceive himself. There was no opposition to or disagreement upon the proposed new constitution until the old question of whether or not the secretary should be a member of the board of direction came up for discussion. The record of what then took place, with the expunging of papers, may be found in the *Proceedings*. It thus seems insincere, perhaps even dishonest, to discuss now and here aught but the real question at issue: Shall the secretary of the American Society of Civil Engineers now and henceforth forever be a member of the board of direction?

Any other criticism of the proposed constitution can safely be left for future consideration, and, if need be, for amendment. The vital question today is as to the general character of the new constitution of the society: Shall it be democratic or autocratic? The material changes which have been proposed have been few, the general tendency followed having only been to be more concise, and to separate the constitution from the by-laws, now for the first time established.

The main changes embodied in the constitution proposed, as has been said, relate to the office of secretary, in two particulars; he is not to be a member of the board of direction; and he is to be elected by the board at its meeting next *preceding* the annual meeting, instead of at the one *following* that meeting. The committee on special committees is made a standing committee under the constitution.

As regards the position of the secretary of the society:

It must be remembered that in the adoption of the constitution of a society such as that of the American Society of Civil Engineers, considerations of who is the present incumbent of that office, his abilities and what may be his own naturally biased opinion on the uses, prerogatives and duties of that office should be wholly disregarded, a constitution being a thing to be fashioned and adopted because of the principles involved, and because of the long future during which it is to act.

No other engineering or scientific society that has been mentioned in the many and manifold considerations that have been given this subject—none of the three other national founder societies—has a secretary that is a member of its governing body. General experience has been against such a proposition. In the case of the American Society of Civil Engineers the secretary has been a member since the early '60s at least, since the time when it was difficult to find enough members resident in New York City to attend actively to the duties of the board of direction; and the plan has been continued, mainly because of inertia, being copied from one constitution to the next one. As a matter of reason, the practice can not be sustained.

The constitutions, old and new, provide in Article VII that there shall be six directors from District 1; but making the secretary a member of the board of direction gives District 1 seven directors. This aggravates a situation, pronounced unavoidable by some, and necessary for effectively conducting the business of the society; yet criticised as unbalanced with respect to the other districts, by other members of the society.

Again, the constitutions named provide that the membership shall elect its board of direction, after nominations in due and extended form, by a committee on nominations, itself created in a decidedly formal manner. But allowing the secretary to be a member of the board of direction places an additional member in the board, with whose election to the board neither the membership nor the committee on nominations has had anything to do.

Constitutions of societies must also take cognizance of the attributes of human nature. It is believed that if a seretary of a society such as the American Society of Civil Engineers is given membership in, and a vote on, the board of direction, it will naturally and always tend to make him self-seeking and autocratic in his notions and actions, instead of causing him to act in a democratic manner, with the best interests of the society, and of civil engineers in general, solely in view. It will tend to make of our organization one modeled on that of some of the typically undesirable political organizations that could be named—a government of men, and not of laws; of self-seeking, and not service.

The secretary of a society such as the American Society of Civil Engineers should not be in position to vote on matters touching his relations to the board and affecting his position and salary in the board. He should not be in position to obscure the issue, and take up the time and energies of the board of direction and of the society, by injecting into the discussion extended arguments of a personal nature whenever matters affecting the office of secretary come up for decision. He should not be in position to have any personal interest in recording proceedings or issuing statements to the membership. He should not be in position to feel that he has the right to canvass for votes to pass or defeat a measure that has been put before the membership for decision. Such action would savor of "pernicious activity," while the office of secretary constantly calls for the exercise of high judicial temperament.

And the board of direction should be in position to exercise the same discretion toward him, with regard to appointment, salary and dismissal, that any employer should exercise for the best interests of the institution which he serves.

On the other hand, it is safe to say that no argument has ever been made in favor of conferring the extraordinary position of member of the board of direction on the secretary that has not been based on the qualities of some particular and, of necessity, more or less ephemeral incumbent, of that office; all of which has no place in the provisions of a constitution set up for a long term of years.

It is believed that the time prescribed in the present or old constitution at which the secretary must be elected is most inopportune, in that about one-third of the board has then little or no detail knowledge of the value or harm to the society of the then incumbent

of the office. In the hurry and excitement of the annual meeting, and the organization of the new board of direction, it is impossible to give the matter the consideration which it should have, and the board should therefore be permitted to make its selection at a time which will avoid these objections. For these reasons the time of choosing the secretary has been changed in the proposed constitution to the meeting of the board next *preceding* the annual meeting.

If a new constitution is not now adopted, how can it ever be adopted? If after two years of work and compromise by an able committee, mere skilfully conducted campaigns are to defeat the labors of that committee, who will again undertake the thankless task?

The importance of this matter is such that every corporate member should in duty bound cast his vote according to his best judgment after giving careful consideration to the questions involved.

The undersigned recommend that the members of the society vote "Yes." But by all means VOTE. And if any who have voted wish to change their votes, they can do so.

HUNTER MCDONALD MORDECAI T. ENDICOTT
JOHN A. OCKERSON J. VIPOND DAVIES
CLEMENS HERSCHEL

Of the Committee on Revision of the Constitution, American Society of Civil Engineers.

Wishes To Serve the Nation; Applications Unheeded

Sir—I should like to see *Engineering News-Record* take up the subject of the delays and unnecessary expenses that the volunteer engineers have met in dealing with the Chief Engineer of the War Department in regard to the examinations for Reserve Officers. I placed my application with the War Department in April, 1917, and it was Oct. 13, 1917, before I was called before a board at El Paso, Tex., for examination. About the middle of December I was notified that no more commissions would be given for some time. I then transferred my papers to the Bureau of Yards and Docks, U. S. N., asking for an examination for the rank of ensign in that department, but to date [Jan. 19] have had no word from the examining board. I think justice to many young men of the country requires the *News-Record* to take up this matter and stop publishing advertisements from these departments for examinations unless applicants get more action.

While the delay may not cause expense to young engineers in the large Eastern cities, unnecessary expense has been incurred by young men in the Western states who had to go four or five hundred miles to an examination, and then never got satisfactory answers from the Engineer Office in Washington as to why they had been turned down. One young man in this town, appointed a first lieutenant in the artillery, had never had a profession in his life and had spent most of his time driving his father's automobile.

We in the West are about as patriotic as Americans in any other part of the country, but we feel that a lot of time has been lost in the appointments to the Officers' Reserve Corps and we should like to learn through your columns what the East thinks of these delays.

Cimarron, N. M. G. H. PALMES.

Single- or Multiple-Cylinder Engines for Road Rollers?

Sir—You are to be congratulated on the most interesting report from France on highway work by Mr. Tomlin, your war correspondent, published in your issue of Jan. 31, p. 198. There is one statement therein which I think needs qualifying or clarifying: that is the blanket opinion condemning the single-cylinder in favor of the double-cylinder internal combustion engines.

I am not writing to flatly contradict the statement in the same general terms in which it was made, but I will state most emphatically that there are many applications wherein the single-cylinder motor is infinitely superior to double- or multiple-cylinder types, one of them very closely associated with highway work and therefore with Mr. Tomlin's article, namely the road roller. Single-cylinder road rollers using gasoline or kerosene have been in successful use for almost 20 years, have proved superior in economy and simplicity to multiple- or double-cylinder types and do equally good road rolling. I estimate there are ten times as many single-cylinder motor rollers in use in the United States as all other types combined.

I feel somewhat qualified to speak on this matter, as I was associated with the production of the earliest motor road rollers in the world and have been continuously in that business ever since. Coutant-Dujour of Paris first, and then J. G. Allen, of Belfast and myself, developed the earliest machines (1898 to 1902) and we were unanimous in using the single-cylinder, 4-cycle motor. I mention this piece of roller history because the conditions that confronted us then were exactly what have forced themselves on all American manufacturers of industrial engines today: namely, we must use kerosene instead of gasoline. In those days motor cars and gasoline were equally rare commodities in Europe, whereas kerosene was cheap and plentiful as it still is today. Since then I designed the first motor-driven rollers made in America (a single-cylinder machine) and for ten years it has been widely and successfully used, almost 2000 being in use.

I think it will be conceded on all sides that a single-cylinder motor of equal power and on the same load will use a great deal less fuel than a double cylinder. Furthermore, in using kerosene, which is a slow burning fuel, the single-cylinder, heavy, slow-speed motor is the best. I am in a position to know that this has been confirmed during the war by the Russian, French and American Governments in succession, selecting single-cylinder road rollers for European use in preference to any other, and each did so after careful independent investigation. I claim that the heavy road roller, in which weight, slow motion and durable parts are such desirable features, lends itself to a single-cylinder motor in preference to any other type. I might also add that four-cylinder vertical engines were applied to road rollers some years ago by a firm in Germany and later by a firm in the United States. Neither of these fulfilled requirements nor has survived so far as I could ascertain.

The double-cylinder engine on road rollers is still on its trial with the evidence all in favor of the single cylinder—especially as regards operating on kerosene and

economy of fuel. For these reasons the double cylinder will likely remain decidedly on the defensive. I say this advisedly, because the firm I am associated with, the Austin Manufacturing Co., Chicago, manufacture both single- and double-cylinder road rollers and was it a position to offer both types to all these Governments but it was largely on the superiority of the single cyl inder in using kerosene, as well as other features, that decided the matter in each case.

I wish to make it clear that I am not condemning double- and multiple-cylinder engines for purposes to which they are better suited, as I or no one else could defend that truthfully or successfully. I will leave it to the specialists in tractors, motor trucks, cars, boats aëroplanes, etc., to determine the motor best suited to their respective needs, which generally speaking are circumscribed by keeping down weights or getting high power into very limited spaces, none of which condition present any difficulty on the road roller. A single cylinder motor properly dimensioned, well balanced and honestly made, will fulfill all the requirements of the most fastidious road-roller men and prove the most durable, simple and economical in operation.

I feel confident the judgment of the engineers of the various armies has not erred in this matter and I thank you for this opportunity of adding my humble opinion thereto. N. DEWIND,

Sales Manager, Austin Manufacturing Co.

Chicago.

Macadam Roads in War Zone

Sir—Like W. J. Weir and C. B. Burdick I am very much interested in the question of war roads as pre sented by the former in *Engineering News-Record*, Sept. 13, 1917, p. 488. As had been pointed out by both writers war roads must be built quickly and under conditions of traffic hardly to be conceived under anything but service conditions. Certain war roads are useful only for a short period and for strategic reasons should be easily removed and projected in other directions.

Near the front line roads are of great strategic value for moving troops quickly, yet as soon as they are registered by the enemy artillery they either cost us tremendous casualties or become obsolete. Farther back they assume a more permanent nature and should be projected with greater care and be made of more lasting materials. Still farther back roads are of less value because the railroads assume greater importance. Railroads give a possibility of moving heavier units at a more rapid rate than roads.

Briefly I should say that for battle arrangements and service conditions roads within two miles of the front line should be of a temporary nature and easily transported from place to place. From two to eight miles back they should be of a permanent nature. From there back the importance of roads drops off somewhat because the railroads should bear the greater weight of traffic. The condition for quick disembarkation of troops and handling of material must be carefully considered in the whole scheme of things, otherwise a great deal of lost motion and delay will be caused. I am considering the roads necessary for the concentration and movement of troops under battle conditions, which is the thing that concerns us most at present. If battle conditions are designed for, road service for trench warfare will be quite sufficient.

For supplies near the front line light railroads in sections easily placed and transported from point to point are the most serviceable. These industrial tracks can be projected even to railhead or to the nearest railroad terminal with some sort of a small dumpy engine for quick transport.

For the strategic concentration of troops and supplies, roads near the front line must be at frequent intervals. For infantry a road of duck boards can be carried in sections by the men in support on their way up on the day of the attack. The enemy has no time to register it in the heat of battle, and the infantry commander can project his road along the most suitable route applicable to conditions presented.

The artillery roads of a temporary nature could be of the corduroy type built in the yard and linked up in short sections. Only light artillery need use them, the heavier pieces being placed over the more or less permanent roads already in existence.

The greatest difficulty in concentrating troops is due to the fact that rapidly moving units cannot travel along a common road faster that the pace of the slowest unit occupying it. Even then the traffic must be in one direction. Batteries need time in which to take up positions and register and should move forward much faster than infantry. Ten roads will move troops more than ten times as fast as one road provided traffic is organized.

In France on most of the battle front macadam road material is scarce and takes a lot of road space to transport. This must be borne in mind. The difficulties presented may not be entered into by any but experienced road builders in coöperation with officers understanding the strategic requirements, if the most economic and best results are to be obtained. J. MCLEAN JASPER,

Captain Imperial Forces, Formerly with Alvord & Burdick, Consulting Engineers, Chicago.

Maresfield Park, Uckfield, England.

Motor Trucks and Central Garbage Furnaces

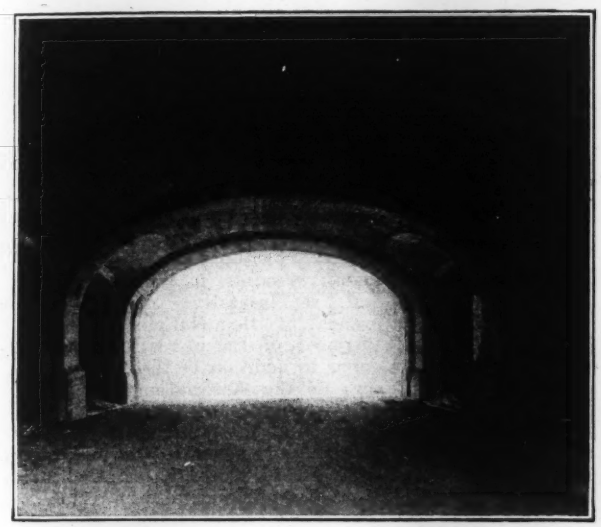
Motor-truck haulage of garbage from two loading stations in outlying sections to an enlarged central incinerating plant, instead of building two new incinerators for these sections, was decided upon recently by the City of Des Moines, Iowa, after thorough study. The present 25-ton plant is being enlarged to a capacity of 75 to 100 tons a day by the Superior Garbage Furnace Co., Dallas, Texas. The cost of the four new furnaces and the extension of the building to house them will be about $40,000. It is expected that the enlarged plant will be in use by April. House to house collections throughout the city will continue to be made by horse-drawn vehicles. For the district which is directly tributary to the incinerator quick-dumping two-horse carts will be used. In the outlying districts the collections will be by end-dump wagons. At the two new loading stations which the city is building the garbage will be transferred from the wagons to 3-ton motor trucks. John W. Budd is superintendent of streets and public improvements, and Karl C. Kastberg is city engineer.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

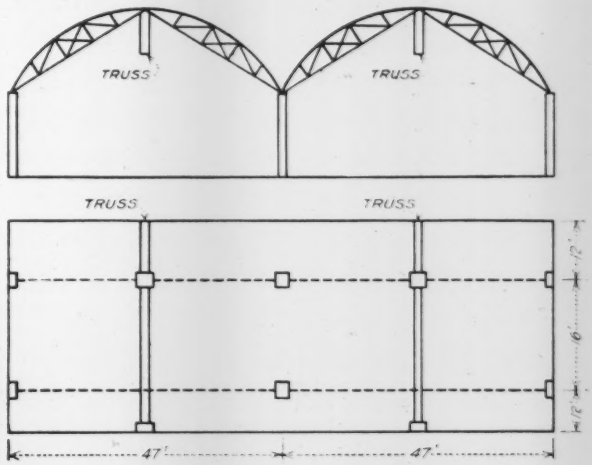
Contractor Builds Warehouse Out of Bridge Forms

A CONTRACTOR'S warehouse does not, as a rule, have to be of any certain hard and fast dimensions. The Koss Construction Co., contractors of Des Moines, Iowa, took advantage of this fact to build a warehouse, at a minimum cost for materials, by using the falsework trusses from the concrete arch bridge shown by the picture. This bridge is located near the state capital at Des Moines. When it had been completed the center



CENTER FROM LARGE ARCH MADE CHEAP ROOF TRUSSES FOR WAREHOUSE

trusses were taken down and used as warehouse roof trusses in the manner indicated by the diagram. The bridge arch had a span of 50 ft., and the center trusses were set up as shown by the diagram to form two 47 ft. span barrel roofs for a 94 x 40 ft. warehouse. George W. Koss is president and H. H. Decker is secretary and treasurer of the Koss Construction Co.



PLACING OF TRUSSES FOR WAREHOUSE ROOF

Timekeeper Must Have "Go-Out-And-Get-It" Spirit

THE successful timekeeper on highway construction is a man of varied accomplishments, permeated with the "Go-out-and-get-it" spirit, according to the specifications for this job given by G. E. Ross, secretary and auditor of the Oregon State Highway Department, in speaking recently before the Northwest Society of Highway Engineers.

The man who is most valuable on construction work, says Mr. Ross, is frequently one who has had very little general office experience. For a man with long desk training it is difficult to develop the activity necessary to make good as a field accountant. The right sort of man for such a job must be alive, have plenty of initiative, a well-balanced judgment, and must consider no job on the project beneath him. Construction work is a poor place to develop dignity, and the man who goes out there with a liberal supply either loses a large portion of it before he has been long in the game or loses his position.

The ideas of the inexperienced applicant regarding the duties of a timekeeper on construction work are frequently amusing. Man after man applies whose general impression seems to be that his duties will consist largely in securing the right kind of clothes, sauntering up and down the highway with his time book under his arm once or twice a day, according to the conditions of the weather, and marking down an X wherever he finds a man employed.

The timekeeper on construction work should be able to handle a large amount of detail. He should take time twice a day or as many times as the nature of the work requires it, and should take it at a different hour every day. He should be familiar with the plans of the engineer or superintendent. He should have a fair knowledge of grading work and should know where every piece of equipment on the job is every day. If he is observing he will gather in his mind a large amount of detail for which perhaps there is no immediate use, but which sooner or later will be called for. He should know what every man is doing every day, and should not be obliged to pester the superintendent with unnecessary questions. His information should be obtained on his own initiative.

The timekeeper should know enough about accounting to handle details thoroughly, but it is far more important that he should be active, energetic and have plenty of initiative.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Cast-Iron Pipe Specifications Again Discussed

New England Water-Works Association Considers Committee Report and Hears Pumping Engine Paper

At the meeting of the New England Water-Works Association in Boston on Feb. 13 the report of the committee on the revision of the Association's standard specifications for cast-iron pipe came up for discussion. The report had previously been printed and sent to all the members. It was confined almost wholly to a reprint of a report by a similar committee of the American Water-Works Association submitted at the Richmond convention of that body in May, 1917. The report was abstracted and the tentative draft of specifications was printed in *Engineering News-Record*, of May 31, 1917, p 449, and letters on the subject appeared in the issue of July 19, 1917, p. 109.

The New England committee indorsed the recommendation of the American committee to the effect that the tentative draft of specifications be sent to all the members for discussion. The New England committee advised that following the discussion on Feb. 13 a questionnaire be sent out to the membership of the New England Association, asking whether the members were in favor of (1) the adoption of a uniform outside diameter; (2) chemical requirements of the metal; (3) relation between flexure and breaking load. Answers to these questions were to be given "with the understanding that no change will be made in the standard specifications for cast-iron pipe and special castings until after the present world war is ended, and not then until after a reasonable period has elasped for the manufacturers to revise their equipment."

It seemed to be the consensus of opinion among those present at the meeting on Feb. 13 that the time had arrived for a revision of specifications and that the program outlined by the committee should be carried out.

In opening the discussion, F. A. McInnes, chairman of the committee, said that that body would very much like to know the cost of making the changes in patterns and molds to obtain a uniform outside diameter for all classes of pipe of a given nominal size; also whether the attempt to attain greater uniformity in metal by means of chemical or physical tests would not be of greater advantage. Thus far, Mr. McInnes said, the committee had not been able to obtain from the manufacturers any information whatever as to the cost of such changes.

(Continued on page 383)

Waite Now Lieutenant Colonel of Transportation Corps

Henry M. Waite, city manager of Dayton, Ohio, has been commissioned Lieutenant Colonel of the Transportation Corps, Engineering Department, and has received a thirty-days leave of absence.

If he still is with the army at the end of 30 days it is expected he will resign. He thus gives up a $12,500 position for one paying $3500.

Mr. Waite became manager of Dayton, the largest city in the country under commission manager form, Jan. 1, 1914. He was born in Toledo, Ohio, May 15, 1869, and was educated in the Toledo High School and Massachusetts Institute of Technology.

HENRY M. WAITE

His training as transitman for the Cleveland, Cincinnati, Chicago & St. Louis Ry. began in 1890. He soon became engineer for the St. Louis division of the company and later division engineer of the Central, New Orleans and Texas Pacific Ry. Co. This was in 1893. Subsequently he became bridge engineer and roadmaster and followed as superintendent of the Cincinnati division of the same road, which position he held from 1889 to 1905.

He later became associated with the Chattanooga division, remaining in this capacity from 1905 to 1907. He was the superintendent of the Seaboard Airline from 1907 to 1909. From 1909 to 1912 Mr. Waite was the vice president and chief engineer of the Clinchfield Coal Corporation at Dante, Va. From 1912 to 1914, when he went to Dayton, he was chief engineer of the Department of Public Works of Cincinnati.

Highway Industries Association Completes Organization

The officers and the board of directors of the Highways Industries Association, organized in Chicago Jan. 21, met in Washington Feb. 15 and completed its organization. At the Chicago meeting the member organizations were directed to report for confirmation nominations of men to act as their representatives on the board of directors. The following were elected at Washington:

Executive committee: A. P. Sandles, a director, representing the National Crushed Stone Manufacturers' Assn.; E. J. Rutherford, a director, general sales manager of the Goodrich Tire Co. and representative in the association of the Motor Car and Accessories Manufacturers' Assn.; A. N. Johnston, a director, and representative of the Portland Cement Assn.; W. P. Blair, a director, and representative of the National Paving Brick Manufacturers' Assn.; Windsor T. White, a director, and representative of motor-truck branch of the National Automobile Chamber of Commerce; all the foregoing in addition to the following officers of the Association, who are *ex officio* members of the executive committee: S. M. Williams, president, a director, and general sales manager of the Garford Motor Truck Co.; A. R. Hirst, vice president, a director, and the state highway engineer of Wisconsin; E. J. Mehren, vice president, a director, and vice president of the McGraw-Hill Co. and editor of *Engineering News-Record*, succeeding Lion Gardiner, resigned; S. T. Henry, vice president, a director, and vice president of the Allied Construction Machinery Corporation.

The other directors of the association are as follows: H. J. Love, representative of the National Stone Assn.; E. G. Sutton, representative of the National Assn. of Sand and Gravel Producers; S. J. Morrison, representative of the National Assn. of Asphalt Block Manufacturers; S. T. Beatty, representative of the National Assn. of Road Machinery Manufacturers; and W. E. Metzgar, representative of the motor-car branch of the National Automobile Chamber of Commerce.

The association will establish offices in Washington at once and enter upon its activities. A program based on suggestions by the executive committee of the American Association of State Highway Officials and by agencies of the Government is being formulated.

It was announced that the industries thus far represented had a capitalization of over $2,000,000,000 and employed over 1,000,000 persons.

Purchase and Supply Director for Army Buying

Details Still Left to Departments, but General Officer Will Supervise Contracts and Production

In the reorganization of the War Department, involving a new system of purchases, the director of purchases and supplies, Brig. Gen. Palmer E. Pierce, will have supervisory charge of all purchases. Associated with and subordinate to General Pierce is Edward R. Stettinius, recently appointed civilian surveyor of purchases and supplies.

The function of Mr. Stettinius will be largely that of a surveyor of the industrial field and an accelerator of war supplies. He is to be largely instrumental in maintaining an even flow of production to the purchasing agencies of the War Department. It is within his province to keep track of the capacity and production of contractors. If there are changes in the requirements of the American Expeditionary Forces orders must be passed down the line by Mr. Stettinius. Mr. Stettinius will also watch closely the transportation and shipping situation.

In conjunction with the division of which General Pierce is the head, the purchasing agencies of the War Department will continue their operations. It is not intended that the director of purchases and supplies shall take over routine activities. He will determine priorities of manufacture and purchase and make estimates of requirements. In this work he will be aided by Mr. Stettinius. The details of purchasing will be handled by the departments, and in the majority of instances the signed contract will be placed before the director of purchases and supplies for final visé. In cases of very large orders it is likely that the director of purchases and supplies will pass upon hte contract both before and after its making.

The office of the director of purchases and supplies thus becomes a clearing house for all orders placed by the War Department. The director of purchases and supplies is the overhead purchasing agency. If the War Department should require some article also required by the Navy, or other departments, or the allied countries, the director of purchases and supplies will confer with a purchasing representative of the other department, and the War Industries Board, and priorities then will be determined. For the internal requirements of the War Department alone the director, General Pierce, is the arbiter of priority. Under this system there will be coördination and overhead regulation in the letting of contracts by the purchasing branches—signal, medical, engineers, quartermaster and engineer.

In addition to his duties as Quartermaster General, Maj. Gen. George W. Goethals will act as director of storage and traffic. He will direct priorities of storage and war traffic in the United States, the embarkation of supplies and troops, inland war transportation and storage at inland points, embarkation points and overseas points.

In exercising these duties General Goethals must work in conjunction with the Shipping Board, the Director General of Railroads, and the several supply bureaus. He will, of course, maintain coöperative relations with the division of purchases and supplies.

Housing Plans Progress Toward Centralization

Washington Correspondence

Both branches of Congress last week passed the bill appropriating $50,000,000 to provide houses for the shipbuilders. The bill now has to go to early conference to adjust some minor differences. This money is to be spent by the Shipping Board which, under the direction of J. Rogers Flannery, is going ahead rapidly on the construction of the remaining houses at Bristol, Penn., and the layout of numerous other projects at other shipyards. Another bill, also appropriating $50,000,000 to be devoted to the other housing needs of the Government, was referred to the House Committee on Labor. It seemed to be progressing favorably through that committee last week when, for some reason unknown, but apparently in accordance with House precedent, it was referred to the Committee on Public Buildings and Grounds, where it is awaiting action.

In testimony before the Labor Committee, John Lind, chairman of the Labor Advisory Committee of the Department of Labor, which is expected to administer the expenditure of funds provided in this bill, explained the immediate housing needs of the many different branches of the Government and outlined the procedure it is hoped to follow. He suggested a centralized control of the whole Government program, leaving the Shipping Board for the present to direct its own work because of the progress it has already made, but with a view toward the eventual assumption of even the shipyard housing by the central direction vested in the Department of Labor. He said that a number of names had been under consideration for the head of this work, but that it had sifted down to two, with strong probability that the one selected would be Otto M. Eidlitz, the New York builder, who is chairman of the section on housing of the Council of National Defense.

Meanwhile, it can be stated that the divergence of opinion of the various elements in Washington dealing with the housing question is gradually disappearing, and that the different departments concerned are working more and more in harmony with one another and with Mr. Eidlitz and his committee. While the shifting of authority for the bill from the House Labor Committee is not altogether understood, it is thought that the Administration is now so definitely committed to a centralization of control under the Department of Labor that Congress will soon be persuaded to pass the act authorizing the new appropriation to be so expended, regardless of which committee assumes the fatherhood of the bill in the House.

Army Cantonment To Be Built In Porto Rico

A cantonment to house the 12,000 drafted men and 650 officers from Porto Rico is to be built near San Juan, P. R. On account of the favorable climatic conditions it is not necessary to build the standard frame houses common to the other National Army camps, but tent accommodations are provided. Preliminary work has already been started under Capt. E. C. Stuart, Engineer Reserve Corps. Purdy & Henderson have the contract.

Bill to Reorganize Army Engineer Corps

The U. S. Senate has passed the bill which provides for the reorganization of the army Engineer Corps. Under the bill the corps will be composed of seven regiments and two mounted battalions, with a brigadier general, 23 colonels, 30 lieutenant colonels, 72 majors, and 152 captains.

McAdoo Will Aid in Transporting Road Materials

The resolutions passed by the American Association of Highway Officials and forwarded to the Federal Government on Jan. 7, through G. P. Coleman, chairman of the association, were answered Jan. 11 by Secretary Houston, whose reply was printed in *Engineering News-Record* of Jan. 17, p. 140. Under date of Feb. 6 Secretary McAdoo, as Director General of Railroads, forwarded the following letter to Mr. Coleman:

"Your letter received inclosing the resolutions adopted at the Richmond meeting by the members of your association, requesting an outline of a policy defining the character of roads or streets for the construction or maintenance of which cars will be furnished for the shipment of materials.

"The United States Railroad Administration will coöperate with the Secretary of Agriculture by transporting materials for the construction of national highways designated by it as a military or economic necessity, when the equipment is available and not needed to move supplies for the army, navy, shipping board, or other governmental activities."

It is felt that this reply of Secretary McAdoo's promises as much aid for highway construction as is needed and could be expected under the circumstances.

Board for Nonmilitary Training for Work in the War

The personnel of the board appointed to take over the control of all nonmilitary training for the war department has been announced. The lines laid down for the board's work were given in last week's issue of *Engineering News-Record*, p. 332.

The civilian members of the board and their fields are as follows: Dr. C. R. Mann, Massachusetts Institute of Technology, engineering schools; Dean James R. Angell, University of Chicago, liberal arts; Dr. S. P. Capen, Bureau of Education; J. Walter Dietz, Western Electric Co., corporation schools; James P. Munroe, Vocational Education Board. The military members of the board are Lieutenant Colonel Rees, Col. Hugh S. Johnson and Maj. Grenville Clark.

Treasury Department Checks Its Building

Secretary McAdoo authorized a statement, in which he said that he had received several inquiries as to whether building operations of one kind and another should be discouraged. With regard to plans for public buildings under the control of his Department, he has stopped letting contracts except in cases where they were absolutely necessary.

Licenses for Dealers in Fuel Oil

In order to conserve the country's supply of fuel oil, which is essential to the conduct of the war, the Government has established a system of licensing all persons, firms, corporations and associations engaged in the business of both manufacturing and distributing fuel oil (including gas oil), whose gross sales of fuel oil (including gas oil) amount to more than 100,000 bbl. per annum. They were required to secure on or before Feb. 11, 1918, a license, to be issued, under such rules and regulations governing the conduct of the business as may be prescribed, by the U. S. Fuel Administration, Washington, D. C., License Division.

Committee To Study Waterways Appointed

The committee to make a rapid survey of the inland and coastwise waterway navigation of the country, predicted in *Engineering News-Record* of Feb. 14, 1918, has been appointed by Director General McAdoo. The personnel is as follows: Maj. Gen. W. M. Black, Chief of Engineers, U. S. Army, chairman; Walter S. Dickey, Kansas City, Mo.; E. A. Tomlinson, Duluth, Minn.; and Col. Charles Keller, Corps of Engineers, U. S. A., secretary. Mr. Dickey, a well-known manufacturer of burnt-clay products, has long been active in promoting waterways transportation improvements and is connected with the Kansas City-Missouri River Navigation Co., which maintains a line on the rivers between St. Louis and Kansas City. Mr. Tomlinson is a Great Lakes shipper and has come into recent notice because of his proposition to build a barge line for coöperation with the New York State barge canal. Colonel Keller is assistant to the Chief of Engineers in particular charge of inland waterways.

Announcement has been made from Director General McAdoo's office that the initial act of the new committee was the assignment of Maj. F. W. Fox and Maj. John Stewart of the Corps of Engineers, U. S. A., to investigate and report at once on the condition of the Chesapeake & Ohio Canal, with recommendations as to its utilization and capacity for traffic. This canal parallels the Potomac River from Cumberland, Md., to the City of Washington. Consideration will also be given to the availability of other waterways throughout the country, such as the Hennepin, the Delaware & Hudson, Morris, New York State Barge, Chesapeake & Delaware, and Delaware & Raritan canals. The coastwise Mississippi and lake traffic will also receive serious attention.

Plans for the Government's Smokeless Powder Plants

Details of the plans and contracts for the construction of two smokeless powder plants for the Government, each to cost approximately $50,000,000, were made public a few days ago.

These plants will be situated at Charleston, W. Va., and Nashville, Tenn. The former will be constructed by the Du Pont Powder Co., through its subsidiary, the Du Pont Engineering Co. The plant at Charleston, W. Va., will be built by the Government.

As an engineering fee, the Du Pont Engineering Co. will receive $500,000 for its preliminary services at Charleston. For this sum the engineering company agrees to obtain from the Du Pont Powder Co. plans, drawings, processes and other requisites to the construction of the plant. For the execution of the contract the building of the plant and the installation of machinery and processes, the Du Pont Co. will receive 3% of the estimated cost of the plant. The total fee cannot exceed $2,000,000. When completed the two plants will be placed under the directorship of Daniel C. Jackling, special representative of the War Department, with Maj. Seeley W. Mudd, Engineers, U. S. Reserves, as assistant director.

Ohio Society Indorses New Body

At the convention of the Ohio Engineering societies held in Columbus, Jan. 29, the Ohio Engineering Society indorsed the Association of Ohio Technical Societies, and gave the trustees of the Ohio Engineering Society power to act in all relations between the two societies during the coming year.

Cleveland May Use Fine Screens for Sewage

Secondary Treatment To Be Required If Year's Test Does Not Satisfy State Health Department

Plans for sewage-treatment works at the W. 58th St. site, Cleveland, Ohio, were conditionally approved on Feb. 4 by Dr. Allen W. Freeman, state commissioner of health. The plans were submitted in person on Jan. 31 by George W. Fuller, consulting engineer, New York City, who was accompanied by Robert Hoffmann, commissioner of engineering and construction, and George B. Gascoigne, sanitary engineer for the city, having been officially transmitted by Alexander Bernstein, director of public service, Cleveland. Dr. Freeman's conditional approval followed after a report on the plans by W. H. Dittoe, chief engineer of the Ohio Department of Health. The action on these plans follows an understanding reached on Nov. 15, 1917, and formulated by Dr. Freeman in a communication to Mr. Bernstein, dated the following day. Dr. Freeman's statement and a brief review of the antecedents in the case were published in *Engineering News-Record* of Dec. 13, 1917, p. 1128.

In accordance with the understanding just mentioned, plans for fine screens and accessories previously submitted to the state authorities have been withdrawn, and new plans have been filed. Broadly, the new plans differ from the old only in providing for a treatment of fine-screen effluent by the activated-sludge process, but the city requests that it shall not be required to build the activated-sludge plant until after the screens have been in use a year, hoping that by then they will have been proved unnecessary. The plans thus far submitted are general.

The main part of the Dr. Freeman's letter of approval of the general plans, addressed to Mr. Bernstein on Feb. 4, follows:

"After due consideration, the commissioner of health hereby approves this proposal and the plans as they apply to bar screens, grit chambers, mechanically operated fine screens, and disinfection appliances, subject to the following conditions:

"(1) That the installation of the activated-sludge or other process for clarification of the fine-screen effluent may be postponed; provided, however, that such process shall be installed promptly if after at least one year's trial of the screens it is found by the State Department of Health that the effluent from the screens does not satisfactorily meet the requirements previously imposed by the State Board of Health.

"(2) That prior to awarding contracts for the proposed fine-screen installation detail plans therefore shall be submitted to the State Department of Health.

"(3) That pending the installation of a secondary treatment process ample provision shall be made for disinfection of the fine-screen effluent, recognizing that special treatment is required due to the presence of iron wastes in the sewage.

"(4) That this approval shall be void unless contracts for those portions of the treatment plant proposed for immediate installation shall have been awarded prior to Sept. 1, 1918.

"In granting the foregoing approval it is the intention to approve the general features of the complete installation as proposed, this action being in accordance with the agreement expressed at the conference of Nov. 15, 1917. The opinion of this department regarding this proposal is fully set forth in our previous communication to you of Nov. 16, 1917. This department has not made a thorough study of the proposal as it relates to the activated-sludge process and while indicating a general acceptance of this process as a portion of the plant as proposed, we hold in abeyance a full approval of the plans and will expect the submission of complete detail plans for this or another secondary-treatment process

"Please acknowledge receipt of this when it is to be installed.
letter and state your acceptance of the conditions imposed."

Cost-Plus and Unit-Price Bids Asked on Viaduct Construction

Cost-plus-fee bids as well as unit-price bids are invited by the Board of Public Works of Kansas City, Mo., in its readvertisement of the Twenty-third Street Trafficway Construction, for which tenders are to be received until Mar. 8. The first call, published in *Engineering News-Record* of Nov. 29, 1917, was unsuccessful; unit-price bids only were specified. The present invitation allows the bidder to name an estimated cost and a profit fee for which he will do the work, but it is stipulated that this fee must not exceed 10% of his cost estimate. The engineers for the work are Harrington, Howard & Ash, of Kansas City. W. C. Weaver, purchasing agent of the board, issues the call for bids.

The work to be done is the construction of nearly 3000 ft. of steel and concrete viaduct.

Dayton Clubhouse Dedicated

The formal dedication on Feb. 2 of the new home of the Engineers' Club of Dayton, Ohio, which was described in *Engineering News-Record* of Jan. 31, p. 234, was made the occasion of a gathering of prominent men.

Among these were Dr. W. O. Thompson, president of Ohio State University; Elmer Sperry, Jr., member of the naval consulting board and inventor of the naval gyroscope; Dr. Clark University, Dr. L. H. Baekeland, member of the naval consulting board, and Col. J. J. Carty, chief engineer of the American Telephone and Telegraph Co.

(Continued from page 380)

Charles R. Wood, for the manufacturers, stated that they were not prepared to discuss the terms of the proposed specifications, but asked that the manufacturers' representatives be allowed to submit suggestions for additional questions to be incorporated in the questionnaire which the committee is to send out. Mr. McInnes said that the committee would welcome any such suggestions. It was the opinion of the meeting that the committee should not be instructed, but that it should use its own judgment upon suggestions.

J. M. Diven, secretary of the American Water-Works Association, asked that arrangements be made to send the circular to members of both associations at the same time. Mr. Diven and other members argued that even if the new requirements suggested by the committee were not adopted, there should at least be a revision and reconciliation of the two existing specifications, to obtain a single standard specification.

The recently adopted standard specification of the British Institution of Water-Works Engineers was referred to, and it was noted that uniform external diameter was one of the requirements of that specification. All of the speakers, other than manufacturers' representatives, were of the opinion that uniform outside diameter was extremely desirable and was well worth some addition to the cost of pipe. A. B. Coulters, representing the Builders' Iron Foundry, stated that it did not appear to them that a change to a uniform outside diameter would be serious.

Mr. Wood stated, for the manufacturers, that there would be no delay in acceding to new specifications when they were shown that any considerable proportion of the purchasers of pipe desired it, but that the manufacturers generally felt that pipe users were well satisfied with present conditions and that it would be a waste of energy and of money to bother with any study of revision, under such conditions.

The discussion was participated in by Patrick Gear, superintendent of water-works, Holyoke, Mass., H. V. Macksey, commissioner of public works, Woburn, Mass., and others.

After this discussion had been concluded a short paper on pumping engines, sketching their development from earliest times to the present date, and drawing some comparisons between high-duty, compound or triple-expansion pumping engines and steam-driven, multi-stage centrifugal pumps was presented by Alfred O. Doane, division engineer of the Metropolitan Waterworks, Boston.

Canada Will Enlarge Its Railroad Equipment

The Canadian government has decided to place contracts for additional equipment for the government railways, to the amount of approximately $7,000,000, in addition to former orders amounting to about $4,000,000.

Highway and Testing Engineers Told of Fineness Modulus

Results of research studies on the fineness modulus of concrete aggregates were presented Feb. 8 to fifty state highway and testing engineers from 21 states and Ontario, Canada. The occasion was a visit of these men to the Structural Materials Research Laboratory of Lewis Institute, Chicago, under the auspices of the Portland Cement Association.

After demonstration in the laboratory Prof. D. A. Abrams explained the theory developed from four years' work, including 50,000 tests, which has led to the conclusions as to methods of proportioning aggregates so that the result may be as definitely predetermined as in the case of steel.

Prof. O. E. Harder outlined a simple field method of detecting organic impurities in sand. Sodium hydroxide, in 3% solution, added to 4½ oz. of sand in a 12-oz. bottle to make the total volume 7 oz., will give a brown color, the depth depending on amount of organic matter present. Five standard color plates are used, corresponding in tint to the reduction in compression strengths of 1:3 mortars when made up with the sand to which various organic matter has been added.

At an evening session and dinner there was discussion of the means by which the theories could be introduced practically into specifications. Professor Abrams has not yet put out any literature on the subject, but indicated that some of the data in blueprint form was available to testing engineers and others.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York.

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 910 Michigan Ave., Chicago; Mar. 19-21, Chicago.

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 20-25, St. Paul, Minn.

The Kansas Engineering Society held its tenth annual meeting at the University School of Engineering, Lawrence, Jan. 15-16. The proceedings of the society are largely reports of research committees. Noteworthy among these were a survey of electrical transmission line systems in Kansas (an apparently unique development in the prairie districts during the past few years); experience with various street pavements in Kansas towns; recommendations regarding grade crossings;

the use of tractors in Kansas; recommendations regarding sewage disposal and stream pollution; and a report of the organization of the State Water Commission. Officers for 1918 are Con M. Buck, Topeka, president; A. A. Potter, Manhattan, vice-president, and Lloyd B. Smith, Topeka, secretary-treasurer. Dues of members in war service are to be paid by the members at home.

The American Concrete Pipe Association in session in Chicago Feb. 8 and 9, elected the following officers for the ensuing year: President, J. L. Ziedler, St. Joseph, Mo.; vice-president, W. E. Goodman; secretary, J. H. Libberton, Universal Portland Cement Co., Chicago. Papers of an engineering nature were presented by G. W. Porter on "Tile Testing"; W. F. Gillette on "Bulk Cement for Concrete Tile Plants"; and R. W. Crum on "Proportioning Mixtures for Concrete Pipe."

The next annual meeting of the **Vermont Society of Engineers** will be held at Burlington, Mar. 13.

On Feb. 5, the **Rochester, N. Y., Engineering Society** listened to an address on "Experiences at Our Army Cantonments," by Dr. W. F. Stone. On Feb. 8 the speaker was Francis W. Davis, Buffalo, N. Y., whose subject was "Increasing the Earning Power of Motor Trucks." Mr. Davis is assistant chief engineer of the truck department of the Pierce-Arrow Motor Car Co. On Feb. 12 the society was addressed by William H. Landreth, deputy state engineer, on "Transportation Facilities of the Barge Canal," and on Feb. 15 by J. E. Freeman, Chicago, engineer of the technical division of the Portland Cement Association, on "Concrete Ships and Barges."

The Colorado Association of Members of the American Society of Civil Engineers held its ninety-third regular meeting on Feb. 9 and was addressed by Milo S. Ketchum, Dean of the College of Engineering, University of Colorado, on "Impressions of War Time Activities in Washington."

The Detroit Engineering Society and the Michigan Chapter of the American Society of Heating and Ventilating Engineers held a joint meeting, Feb. 15. The speaker of the evening was Dr. E. Vernon Hill, sanitary engineer, Board of Health, Chicago, who spoke on "Ventilation—The New Science vs. The Old Art."

The following organizations are included in the **Association of Ohio Technical Societies**, the formation of which was noted in *Engineering News-Record* of Feb. 7, p. 282: Cleveland Association of Members of the American Society of Civil Engineers; Cleveland Engineering Society; Cleveland Section, American Institute of Electrical Engineers; Columbus Chapter, American Institute of Architects; Engineers' Club of Cincinnati; Engineers' Club of Columbus; Engineers' Club of Dayton; Engineers' Club of Youngstown; Northwestern Ohio Surveyors' Association; Ohio Engineering Society; Ohio Society of Mechanical, Steam and Electrical Engineers; Toledo Society of Engineers.

More than 200 members of **The Engineers' Club of Kansas City, Mo.**, attended the sixth annual dinner of the organization Jan. 29. An address on concrete ships was delivered by J. E. Freeman, engineer of the technical division of the Portland Cement Association. The following officers for the year were elected: Alfred Hurlburt, president; F. B. Scheetz, first vice-president; A. C. Everham, second vice-president; Robert S. Beard, secretary; H. B. Treadway, Ralph R. Benedict and William Bugg, executive committee.

The Engineers' Club of Dayton, Ohio, had as its guest of honor at a dinner Feb. 4 Prof. C. Frank Allen, former head of the civil engineering department of the Massachusetts Institute of Technology.

The tenth annual convention of **The North Dakota Society of Engineers** will be held at Fargo, Feb. 21-22.

The Engineers' Society of Milwaukee, which is the Milwaukee section of all national engineering societies, held its regular meeting Feb. 13 under the auspices of the Milwaukee section of the American Society of Refrigerating Engineers.

The Engineering Association of Nashville, Tenn., held its regular monthly meeting Feb. 4. The metering of sprinkler systems, smoke abatement and other important questions were discussed.

At the meeting of **The Providence Engineering Society,** Feb. 20, the subject was "Waterpower Development in New England." The speaker was Henry I. Harriman of Chace & Harriman, Boston. Mr. Harriman is president of the Boston Chamber of Commerce. The first annual smoker and members' night of the society will be held March 4. The speaker of the meeting will be R. Livingston Beeckman, governor of Rhode Island, who is a member of the society. He will describe some of his experiences on the battle front of Europe. On Feb. 27 the municipal engineering section of the society was addressed by James A. McKenna, of the city engineer's department, Providence, who gave an illustrated talk on "Electrolysis Mitigation."

The Louisiana Engineering Society held its regular meeting Feb. 11. The technical exercises of the evening consisted of a paper, "Some Notes on Wireless Telegraphy," by Prof. P. E. Lehde.

The recent annual meeting of **The Seattle Association of Members of the American Society of Civil Engineers** was addressed by Alexander R. Smith, New York City. His subject was "Part Development in the United States in Connection with Recent Activities in Water Transportation." The following officers were elected by the association to serve during 1918: A. S. Downey, president; L. M. Grant, vice president; P. A. Franklin, secretary-treasurer. J. L. Hall was reëlected for a 3-year term as councillor.

The regular meeting of **The Brooklyn Engineers' Club** was held Feb. 14. A paper on "Some Notes on the Development of Electric and Gas Facilities in Central and Eastern Long Island" was presented by Andrew F. Johnson.

The Civil Engineers' Society of St. Paul held its annual banquet at the St. Paul Association, Jan. 26. A reception to the new officers of the society, A. F. Meyer, president; E. S. Spencer, vice president; P. C. Gauger, secretary, and E. O. Koremo, treasurer, was held. About 150 engineers attended the banquet.

The Minnesota Surveyors' and Engineers' Society will hold its annual convention in Duluth, Feb. 21-23.

The twelfth regular meeting of **The Nebraska Association of Members of the American Society of Civil Engineers** was held in Omaha, Feb. 11.

The annual meeting of **The Oregon Society of Engineers** was held Feb. 4 at the University Club, Portland.

The Feb. 6 meeting of **The Engineers' Club** and **The Associated Engineering Societies** of St. Louis, was not held at the club rooms, as usual, but instead the attendance of the members at the convention of the American Roadbuilders' Association was requested.

The Montana Institute of Municipal Engineers at its annual meeting, held in Bozeman recently, elected John D. McLeod, city engineer of Helena, president of the Institute.

The next meeting places of the **Southwestern Society of Engineers** will be at Douglas, Bisbee and Tucson, Ariz., on Apr. 18, 19 and 20. One day each will be spent by the engineers at Douglas, Bisbee and Tucson, the delegates traveling between the places at night and holding their meetings during the day.

Among the officers installed at the recent meeting of the directors in El Paso, Tex., were:

G. M. Butler, of Tucson, Ariz., president; S. H. Worrell, of El Paso, first vice-president; Gerald Sherman, of Bisbee, Ariz., second vice-president; R. W. Goddard, of State College, N. M., treasurer; C. E. Barglebaugh, of El Paso, secretary.

The Kentucky Association of Road Engineers held a meeting at Newport, Feb. 13-15, at which several important road questions were discussed.

The annual dinner of the **Minnesota Engineering Societies,** arranged by the Minnesota Joint Engineering Board, will be given Feb. 22 at Duluth. Addresses will be delivered by Mayor C. R. Magney, of Duluth· C. E. Drayer, Sec-

retary Cleveland Engineering Society; W. L. Darling, Railway Representative to Russia; University of Minnesota, Dean Allen; Geo. L. Wilson, Representative Minneapolis Engineers' Club, and George H. Herrold, Representative Civil Engineers' Society, St. Paul. At the business meeting, Feb. 23, various matters of engineering interest will be discussed.

PERSONAL NOTES

MILO S. KETCHUM, dean of the College of Engineering, University of Colorado, has been granted a leave of absence by the Regents of the University to accept a position as an assistant director, acting under D. C. Jackling, director in charge of the construction of U. S. Government explosives plants. Mr. Ketchum will be located at Charleston, W. Va., as assistant director in charge of the construction of the explosives plant that is being constructed near that place. His address for the present will be 16 E. 42d St., New York City.

MAJ. R. K. ROCHESTER, Cleveland, Ohio, has been made general manager of a railway in France. He is a graduate of Rose Polytechnic Institute and has been connected with the Pennsylvania system for a number of years, recently as superintendent of the Cleveland and Pittsburgh division.

HENRY C. NUTT, general manager of the Los Angeles & Salt Lake R.R., has offered his services to the Government, to aid in railroad construction and reconstruction in Belgium and France. Mr. Nutt was formerly with the Chicago, Burlington & Quincy Railroad Company.

CARL H. NORDELL, formerly engineer of designs, Sewerage Commission, Milwaukee, is now with the Air Nitrates Corporation, New York City, in charge of water supply, sanitation and roads in connection with the plant at Muscle Shoals, Alabama.

C. E. WILLIAMS, who has been instructor in civil engineering for five and a half years at Lafayette College, has resigned to accept a position as testing engineer in the research department at the Palmerton, Penn., office of the New Jersey Zinc Company.

H. V. DICKINSON has been promoted from first sergeant of F Company, Twenty-third Engineers, to master engineer, senior grade, at Second Battalion headquarters, Laurel, Md.

J. H. ROACH, valuation engineer of the New York Central R.R. west of Buffalo, has been made valuation engineer as well of the lines east of Buffalo. G. W. Kittredge, chief engineer of the New York Central east of Buffalo, and supervising valuation engineer of the entire New York Central system, is made consulting valuation engineer of the system, remaining chief engineer of the Eastern lines. Mr. Roach first entered the service of the Lake Shore and Michigan Southern Ry. in 1907, and was made valuation engineer in 1914, before the Lake Shore became a corporate part of the New York Central.

H. F. BRONSON, R. F. IRWIN and W. C. RIDDLE, assistant engineers, Pennsylvania State Department of Health, have been commissioned captains in the Sanitary Corps, National Army, and have received leaves of absence.

F. E. WINTER, district engineer, Pennsylvania State Highway Department, has been commissioned captain in the Engineer Reserve Corps, and assigned to duty at Camp Lee, Virginia. He was formerly in charge of highway district No. 8, with headquarters at Dubois, Penn.

W. E. BROWN, who was formerly assistant division engineer of the Pittsburgh division, Pennsylvania Railroad Lines East of Pittsburgh, has become division engineer at Elmira, N. Y.

GORDON GRANT has been appointed expert adviser to the Canadian Minister of Railways, occupant of a new office created by the Dominion government.

FRED CUNNINGHAM has been appointed engineer of Denton County, Texas.

DR. ALLAN MCLAUGHLIN has resigned as health commissioner of Massachusetts, as a result of his recall to Washington to take the post of Assistant Surgeon General in the Public Health Service of the United States. His resignation will take effect Mar. 31. As second in command in the Surgeon General's office, Dr. McLaughlin will have control of all the domestic health work in the United States, particularly with respect to military cantonment areas.

WILLIAM P. KENNEY was elected president of the Great Northern R.R. Feb. 12. He was formerly vice-president in charge of traffic.

RALPH BUDD, formerly assistant to the president of the Great Northern R.R., was elected executive vice president at the meeting of the board of directors Feb. 12. Mr. Budd was formerly chief engineer of the Great Northern and before holding that office was chief engineer of the Spokane, Portland & Seattle Ry. and affiliated lines. He was born in Waterloo, Iowa, 40 years ago and began his railroad career as a draftsman, rodman and instrument man on the Chicago Great Western.

R. H. PINKHAM, division engineer of the Pittsburgh division, Pennsylvania Railroad Lines East of Pittsburgh, has been promoted to the position of assistant superintendent of the Pittsburgh division, with headquarters at Cresson, Penn. His place as division engineer of the Pittsburgh division has been taken by Robert Faries, who has been division engineer at Williamsport, Penn.

C. E. ZORTMAN has been transferred from the position of division engineer of the Conemaugh division, Pennsylvania Railroad Lines East of Pittsburgh, to that of division engineer of the Delaware division.

PARKER-GOULD & CO., civil engineers, Seattle, Wash., recently announced the reorganization of the company and removal to the L. C. Smith building. The firm, organized in 1892 at Stixrud & Nasten, and more recently as Nasten, Parker & Gould, will enlarge its business to include industrial and public utility engineering. For this purpose, G. R. Collins, who has had 16 years' experience in public improvements, has joined the staff as consulting engineer.

H. G. STOKES, city engineer of Kewanee, Ill., has also been selected to serve as county surveyor of Henry County. He succeeds Curtis C. Martin, of Geneseo, Ill.

A. A. MATTHEWS has been appointed chief engineer of the St. Louis Southwestern Ry. of Texas. He succeeds W. T. Eaton, who has been assigned to other duties. Mr. Matthews' office is at Tyler, Tex.

PAUL M. LA BACH, until recently assistant engineer of the Chicago, Rock Island and Pacific Ry., has been commissioned as major in the Engineer Reserve Corps. He will perform staff duty in France. A commission as ensign in the Naval Reserve was held for a short time by Mr. La Bach, but he preferred the army service, although he served as an ensign in the Spanish-American War.

STEPHEN A. STAEGE, Watertown, N. Y., announces that the firm of Staege & Dewey has been dissolved. He will continue in practice as a consulting engineer.

E. J. AYARS, who was formerly division engineer of the Allegheny division, Pennsylvania Lines East of Pittsburgh, has been made division engineer of the Williamsport division.

C. H. BUFORD, trainmaster of the Chicago, Milwaukee & St. Paul Ry., at Sioux City, Iowa, and formerly assistant engineer in charge of track elevation in Chicago, has been transferred to Milwaukee.

The TAIT ENGINEERING CO., Straus Building, Chicago, is the new name of the Concrete-Steel Products Co. The change is made because the company now confines its practice to professional engineering, while until about two years ago it engaged in the manufacture and sale of steel. Its special line of work is structural design in steel and concrete.

CHARLES W. RICHEY, who was formerly master carpenter of the Pitts-

burgh division, Pennsylvania Railroad Lines East of Pittsburgh, has been made assistant division engineer of the Pittsburgh division.

V. B. WAGNER is now chief engineer of the Cripple Creek & Colorado Springs R.R., with headquarters at Colorado Springs, Colo. He succeeds M. J. Burgdorf. Mr. Wagner was formerly chief engineer of the Colorado Midland R.R. Company.

HERBERT E. HOWES, formerly assistant engineer with the St. Anthony Falls Water Power Co., Minneapolis, has been appointed assistant hydraulic engineer with the St. Lawrence River Power Co. at its Massena, N. Y., plant.

WILSON S. KINNEAR, E. L. LITTLE and CARL H. STENGEL announce the opening of the office of W. S. Kinnear & Co., engineers and investigators, at 111 Broadway, New York City.

C. M. WISMAN, the new division engineer of the Allegheny division, Pennsylvania Railroad Lines East of Pittsburgh, was formerly division engineer of the Elmira, N. Y., division.

A. J. HAHM, attached until recently to the office of the county highway engineer, Logan County, Illinois, is now a member of the 416th Railway Telegraph Battalion, at Chicago.

C. E. HICKOK, city engineer and superintendent of streets of Alameda, Calif., has been appointed captain in the U. S. Engineer Reserve Corps.

ARTHUR SURVEYER and R. DE L. FRENCH have formed a partnership under the name of Arthur Surveyer & Co., for the general practice of engineering, with offices at 274 Beaver Hall Hill, Montreal, Que. Mr. Surveyer has conducted the business under this name for the past seven years, while Mr. French has been principal assistant engineer for R. S. & W. S. Lea, consulting engineers, Montreal, and lecturer in civil engineering at McGill University since 1911.

S. L. CHURCH, formerly division engineer of the Delaware division, Pennsylvania Railroad Lines East of Pittsburgh, has been made division engineer of the Conemaugh division.

A. C. LINDBERG, until recently at Camp Devens, Ayer, Mass., with Fred T. Ley & Co., is now with the Thompson-Starrett Co., as superintendent of the sewer division in the construction of the powder plant for the Government near Charleston, W. Va.

COMMANDER GEORGE A. MCKAY, until recently in charge of public works at Great Lakes, Ill., has gone to Honolulu, where he will have charge of completing the dry docks being built there for the Government.

M. J. FALKENBURG and I. F. LAUCKS, Seattle, Wash., heretofore associated as Falkenburg & Laucks, have announced the dissolution of the partnership, effective Feb. 10.

NORMAN F. BROWN, for the past sixteen years assistant engineer of construction at Pittsburgh for the Pennsylvania Railroad, has left for France, having been commissioned a major of engineers in the railway expeditionary force of General Pershing's army. Major Brown has served as a member of the Pennsylvania Railroad engineering corps since his graduation from the University of Pennsylvania in 1898. As assistant engineer of construction he has had charge of construction work in the Pittsburgh district and completed the union station, the Duquesne way elevated structure and other important works.

R. C. YEOMAN, professor of highway engineering, Purdue University, Lafayette, Ind., has been appointed chairman of the engineering section of the research committee of the Indiana State Council of Defense. Problems already referred to this committee are as follows: Military highway routes; road use in the spring of year; ice jam conditions in the Ohio.

W. L. ELKIN, division engineer at St. Louis of the Pennsylvania Lines West of Pittsburgh, has been appointed superintendent of the Peoria division, succeeding Taber Hamilton, who has been transferred to the Louisville division, vice H. E. Newcomer, transferred.

R. H. GILLESPIE recently left the service of the City of New York. For the past eight years he has been chief engineer of sewers and highways for the borough of the Bronx.

OBITUARY

CAPT. PHILIP VINCENT SHERMAN, who was drowned in the torpedoing of the "Tuscania," was a graduate of Norwich University, Northfield, Vt. Captain Sherman was born in Cornwall, Ontario, Canada, Sept. 11, 1885. He attended the public schools of Burlington, Vt., and in 1903 entered Norwich University. He was graduated with the degree of bachelor of science in civil engineering in 1907. Soon after his graduation he entered the employ of the maintenance-of-way department of the Missouri Pacific R.R. Before entering the army he was assistant engineer at Kansas City, Kan. He is survived by his widow and three children, the oldest being eight years of age.

AUGUSTINE W. WRIGHT, railway construction engineer, died at his home in Los Angeles, Calif., Feb. 3. He was born in Chicago 71 years ago. In the late sixties Mr. Wright had charge of much of the construction of the Union Pacific R.R., and later he led the first engineering squads into the Northwest for the building of the Northern Pacific Ry. For five years he was chief engineer of that road. In the early seventies Mr. Wright turned his attention to cable railways and he worked out the first system established in Chicago under Mr. Yerkes, and was chief engineer of the system for a number of years. In 1889 and 1890 he built two cable-car lines in St. Louis and also the first line of that kind in Los Angeles. Mr. Wright was consulting engineer in the building of the first cable street railroad in New York. He went to California in 1889 and became an orange grower near Pomona, but removed to Los Angeles in 1912. At the time of his death he was a member of the Los Angeles Board of Public Utilities.

HENRY J. MCNICHOL, for thirty years a prominent sewer contractor in Chicago, died Feb. 4. He was born in Liverpool, England, in 1860, and was brought to Chicago in 1868. Before he was of age he took his first contract and met with disaster on a quicksand job. Later, for five years, he was chief masonry inspector of the City of Chicago. In 1906 he built 18 miles of sewer in Lyons, Ill., and the next year had a $500,000 job in Litchfield, Ill. Many of the sewers of the Sanitary District were built by his company. His largest contract, taken in 1916, was the Norwood Park $750,000 trunk sewer for Chicago. For twenty years he was president of the Chicago Sewer Contractors' Association. His two sons, A. J. and Richard, were associated with him in business.

CHARLES GREENLEAF GRIFFITH, who died in New York, Feb. 12, was a graduate of the Troy Polytechnic Institute, class of 1877. He was one of the engineers who laid out Prospect Park, Brooklyn, N. Y. He was also one of the younger engineers who planned and helped to build the first elevated railroad on Ninth Avenue, New York City. Later Mr. Griffith became one of the pioneers of the great Northwest and did professional work in locating the Great Northern Railway over the Rocky Mountains as well as other important engineering. After this Mr. Griffith became a mining engineer of prominence, residing in Great Falls and Helena, Mont., for some years. About twenty years ago he returned to his home in New York City and about ten years ago retired from active business.

PETER H. LALLANDE, contractor, Birmingham, Ala., died there Feb. 7. For many years he was associated with the contracting firm of Dunn & Lallande, but in recent years had been working independently. He handled many of the largest construction enterprises in his section of the South.

MARCEL J. BEULLAC, a member of the engineering staff of the Dominion Bridge Co., died recently at his home in Montreal. He was a special lecturer on structural engineering at McGill University.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Building Organizations Combine To Aid the Government

Forty New York Associations to Work as Unit on Shipbuilding and Housing Problems

With the object of centralizing their work in coöperation with the government, forty of the building trades, construction and architectural organizations of the metropolitan district of New York have formed the Building Industries of New York.

This central body will endeavor to coöperate with the Government in its shipbuilding and housing problems. Efforts will be made to anticipate the Government's demand for construction materials and yet keep production well within the bounds of necessity in order to avoid unnecessary accumulation of stocks of materials.

The new organization includes the National Lime Manufacturers' Association, the Plate Glass Manufacturers of America, the Building Material Exchange of New York, the Real Estate Board, the Chamber of Commerce of Queens Borough, the Credit Association of the Building Trades of New York, the thirty members of the Building Trades Employers' Association, the New York and Brooklyn Chapters of the American Institute of Architects and the New York Architectural Society.

Officers were elected as follows: President, Hugh Getty, president of the Building Trades Employers' Association; vice presidents, Ernest R. Ackerman, president of the Lawrence Portland Cement Co.; Laurence McGuire, president of the Real Estate Board, and F. T. Miller, president of the F. W. Dodge Co.; secretary, Allen E. Beals, publisher of the Dow Service Daily Building Reports; treasurer, G. Osgood Andrews, Eastern representative of the Plate Glass Manufacturers of America.

Passing of "Heatless Monday" Heralds Increased Production

Following close after the ten-day thaw which loosened the bonds of winter on railroad motive power, came the word from Washington that the last "heatless Monday" had passed. More effective than any embargo on or shutdown of industry was the mild weather that permitted repairs to overworked locomotives, the clearing of railroad yards and the movement of long strings of loads and empties. Coke began to flow from Connellsville and other coke centers to the blast furnaces. Byproduct coke is being produced in larger volume, as these ovens are largely dependent upon rail movements of coal. The byproduct ovens were operating at 75 per cent. of capacity last week. Steel output will soon feel the stimulus of increased pig iron production and the resumption of rail traffic. Steel mills kept pace with the country's major war needs, in spite of all difficulties. Shipbuilding plates and structural shapes both for equipping shipyards and building ships were produced in sufficient quantity to meet all demands.

It looks as though the railroads have reached "the top of the grade" at last.

Great improvement in the steam coal supply was reported from the South and Middle Atlantic States. Shortage of steam grades still existed in Ohio and the Great Lakes cities, but the outlook was good.

Thew Wins Important Decision

A court decision of interest to all manufacturers of construction equipment who maintain branch offices in New York State but whose home offices are elsewhere, has been rendered in favor of the Thew Automatic Shovel Co. by a New York court.

As plaintiff the shovel company was given judgment for $1793.06 against Christopher & Lockwood, contractors, to cover costs and a claim of $1700 for a payment due on a steam shovel. The claim was made that the Thew Automatic Shovel Co., being an Ohio corporation and not registered in New York State, was barred from bringing suit. Judge Morschauser, presiding at White Plains, N. Y., decided that the shovel company was simply represented in New York State by a salesman and that, although the contract was made in Ohio, the company was privileged to bring suit in New York.

Ask Industries To Make Room for Crippled Soldiers

A questionnaire has been sent out by the Pennsylvania Department of Labor and Industry, to aid in placing disabled soldiers, sailors and marines who return from war service. Each firm is requested to tell how many disabled men can be used.

Tramway To Unload Vessels

All lumber received at the Benicia shipyards hereafter will be unloaded from vessels by means of an aërial tramway, connected with 200-ft. towers. An easement of 49 years across certain streets has been secured from the city.

Lion Gardiner Joins "Lakewood"

Lion Gardiner, director of the civil engineering publications of the McGraw-Hill Co., Inc., has resigned to become manager of field sales for the Lakewood Engineering Co., with headquarters in Cleveland. Mr. Gardiner has been the inspiring force behind many important movements in the manufacturing fields related to civil engineering and construction.

Mr. Gardiner entered industrial work as assistant superintendent of a machine shop in Chicago. When the Chicago

LION GARDINER

Tunnel work started (the 61-mile freight tunnel in the Loop District of Chicago) he joined the engineering force of George Jackson, Inc. He was graduated from the University of Illinois in mechanical engineering in 1909. For the following three years he was engaged in manufacturing and construction work with the W. H. Zimmerman Co., consulting and construction engineers, Chicago.

In 1912 Gardiner joined the business staff of *Engineering Record* and two years later became western manager. Shortly after the consolidation of *Engineering News* and *Engineering Record* he was appointed director of the new journal and of the *Contractor*. With a broad and intimate knowledge of the engineering and construction fields, he completed researches of high value to *Engineering News-Record* advertisers.

Mr. Gardiner's work has always been guided by keen foresight, broad vision and well-founded knowledge. Added to a record for successful accomplishment he has a capacity for winning and holding friends that augurs well for him in the career which he is entering at Lakewood.

In the Market for Equipment

The Crescent Tool Co., Jamestown, N. Y., is preparing plans for a power station and concrete coal-storage bins, and will shortly be in the market for one 1000-kw. steam turbine generator set and boilers, also a 1500-hp. gas producer for supplying gas engines, forges and furnaces.

Francis D. West Joins Permutit Co.

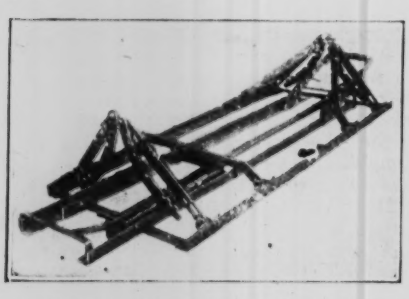
Francis D. West, who has been chemist in charge at the Torresdale laboratory, Philadelphia Bureau of Water, for the past ten years, has resigned to become sales representative for New York State of the Permutit Co., manufacturers of filters. Mr. West has been active in the work of the American Water-Works Association and New England Water-Works Association. His research work and contributions to the technical press on the subject of bacteriology have gained wide recognition.

Collapsible Arch Culvert Form

A new type of "one-man" collapsible culvert form, with segmental arch roof, has been brought out by the Storms Manufacturing Co., Monadnock Bldg., Chicago. Four sections will build a 30-ft. culvert. The forms are

CULVERT FORM OPEN

adjustable for various widths, and are intended to do away with the need for timber bracing, to reduce labor costs, and to produce a culvert free from sagging.



KNOCKED DOWN READY TO MOVE

One man can readily set up this portable form centering and knock it down to move to a new job.

Lime Manufacturers Postpone Meeting

The annual meeting of the National Lime Manufacturers' Assn., which was scheduled to be held early in February in Chicago, has been postponed until Apr. 3 and 4.

TRADE PUBLICATIONS

Catalogs Wanted by Army Engineers

A file of catalogs of road, quarry and bridge machinery and equipment is being made by the special highway regiment, the 23d Engineers, with headquarters at Laurel, Md. Manufacturers are requested to send five copies of all catalogs and other literature to John J. Huber, Acting Adjutant, 2nd Battalion.

"'You Sure Did Your Duty,' says Uncle Sam," is the title of an attractive folder on cantonment construction, just issued by the C. H. & E. Manufacturing Co., Inc., of Milwaukee, Wis., makers of the portable saw rigs so widely used by cantonment contractors.

Smooth-On Instruction Book No. 16 has been issued by the Smooth-On Manufacturing Co., Jersey City, N. J., which describes the use of various cements for repairing breaks or leaks in iron pipe, castings, etc., and also contains the standard sizes of "Smooth-On" coated corrugated gaskets for flanged pipes from 2 in. to 26 inches.

Catalogue "E" describing hydro gas meters has been issued by the Bacharach Industrial Instrument Co., 422 First Ave., Pittsburgh, Penn. This contains information as to the various methods employed in measuring gases and shows the application of these meters to blast furnaces, gas works, by-product coke ovens, etc., as well as measuring air for building ventilation.

Notes of the Industries

The Standard Slag Co. is preparing plans for the reconstruction of its plant at Ironton, Ohio.

There has been a consolidation of the Moline Automobile Co., makers of Moline-Knight motor cars, and the Root & Van Dervoort Engineering Co. The new company will be known as the Root & Van Dervoort Engineering Co. of East Moline, Ill., an Illinois corporation. The officers and management remain the same and there is no change other than in the name of the company. During 1918 the Root & Van Dervoort Engineering Co., in addition to building Moline-Knight automobiles, will have a big production of stationary engines, tractor and automobile motors.

"All the concrete to be placed by the pneumatic method on the Ford smelter plant job at Detroit will be mixed with hydrated lime," said Norman G. Hough, manager of the Hydrated Lime Bureau, when seen in New York recently. "There are 3000 tons on the job now, to be used in building the first of the three units of the plant."

Robert S. Barrett, of Alexandria, Va., has been appointed commercial attache to the American Embassy at Buenos Aires, according to an announcement made by the Bureau of Foreign and Domestic Commerce, Department of Commerce. He will also act as the War Trade Board's representative in Argentina.

The Hoisting Engine Sales Co., of New York, was incorporated recently as the Hoisting Engine Sales Co., Incorporated. The following officers were elected: William C. Cist, president; Archer Armstrong, vice president and general manager; H. Haaman, secretary and treasurer.

The Rensselaer Valve Co., Troy, N. Y. announces the following appointments in its sales organization, effective Feb. 1: Charles L. Brown, sales manager, New England branch; A. E. Jones, sales manager, Chicago branch; George M. Keefer, sales manager, Pittsburgh branch; John S. Warde, Jr., sales manager, New York branch.

Frank Bartholomew, who has been erecting engineer for the Shaw Electric Crane Co. for the past 20 years and who resigned his position with that company in December, 1917, has become associated with N. B. Payne in the Havemeyer Building, 25 Church St., New York City, specialist in electric cranes.

Dodge & Dodge, New York, and A. M. Anderson & Co., Chicago, dealers in machinery and equipment for contractors and builders, have consolidated their businesses under the name of Dodge & Anderson Corporation, with offices at 501 Fifth Ave., New York, and 1340 Old Colony Building, Chicago.

James A. Harris, Jr., for many years advertising manager of the White Co., has resigned to accept a commission as captain in the quartermaster corps. Captain Harris has already assumed his military duties, having been assigned to Mechanical Repair Shop Unit No. 305. He will be succeeded as advertising manager by Millard H. Newton, who has been connected with the company's advertising department for the past five years.

The Ransome-Leach Co. announces that one large warehouse will be established in each principal city for the purpose of handling the combined lines of Ransome concrete machinery and Oshkosh concreting and woodworking equipment.